AVIATION WEEK

FEB. 27, 1950

A McGRAW-HILL PUBLICATION

The Seventeenth Annual
INVENTORY OF AIR POWER

NEW! *Esna Gang Channel Strip* **PROVIDES PERMANENT FASTENERS FOR APPLICATIONS SUBJECTED TO REPEATED "ON-OFF" USAGE**

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The extra tough aluminum alloy used for this new product provides additional strength for these unusual assemblies and a new method of cut and raised dimpling retains the nuts securely, and prevents over riding.

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Aviation Week

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Inventory of Air Power

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Aviation Week's Own

Forecast for 1950 . . .
$2.6 Billion Revenue

AVIATION REVENUE in 1950 will total slightly better than $2,600,000,000 for aircraft, engine, propeller and parts manufacturers, and domestic, international and feeder airlines combined.

You can add to this several hundred million dollars more for associated industries, such as makers of avionic equipment. It will make it about a $3 billion year.

That is the conclusion reached after studying the mass of material the staff of AVIATION WEEK assembled for this issue—the most up to date and comprehensive analysis of air power.

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MILITARY EXPENDITURES, more than ever, are the key to manufacturing activity this year. Commercial business will be the lowest since before the war.

Fiscal 1951 expenditures may go down, but the airframe and engine makers will continue at an accelerated pace on previous years' appropriations not yet spent (page 13). Revenues for this year, at least, will be fairly independent of national economic tides or foreign developments.

President Truman in his budget message, said $5.3 billion will be available for aircraft procurement in fiscal 1951 and succeeding years. Better than $3 billion of that already is appropriated.

Military expenditures and airframe weight accepted in calendar year 1950 will be up, but units will be below those of 1949 (page 25).

Forecast for 1950: 2400 planes, 34.5 million lb and payments to military airframe contractors of $1.2 billion.

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MANUFACTURING REVENUE (airframes and engines) will be largely decided by ability to produce. There is more manufacturing space in use now and "produceability" is getting more study (page 25).

Airframe manufacturers are faced with the job of getting more new types in production—particularly fighters—than at any time since the war.

Because of that, most military deliveries this year should be large bombers and transports already in production. So airframe weight will go up, units come down.

About two-thirds of total manufacturing revenue will go to prime airframe contractors. Suppliers and subcontractors now furnish about 50–60 percent of a finished airframe. Engine manufacturers get about one-third of total revenue.

Forecast for 1950: total manufacturing revenue of $1.9 billion; airframe weight totaling 39.7 million lb.

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COMMERCIAL TRANSPORT manufacturing will continue to slide. Last year, transport deliveries (page 35) were below those of 1948. The picture looks no better now. However, there is one loophole. Our forecast for 1950 does not take into account any orders for twin-engine transports from Eastern or TWA. If those are placed, they will total 50 or more planes—many of which could be delivered this year.

But, the Allison experiments with its turboprop Convair-Liner might blur the whole twin-engine picture. Prospective customers of Martin or Convair might decide to wait until the view clears.

Forecast for 1950: 116 planes valued at $70 million.

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PERSONAL PLANE shipments show no sign of improvement. Actually, term "personal plane" now is a misnomer as most of the sales are for executive, industrial or agricultural use.

But even that doesn't make the selling job any easier. Use of planes in agriculture is growing, but they are mostly old types. New agricultural planes are being designed, but they will not be in production this year, at least in any numbers. Farmers' costs are going up; their revenues coming down. No one knows what this will do to agricultural plane sales.

Executive or salesman use of a small airplane is demonstrably the cheapest way to travel in many instances—but it hasn't been widely enough demonstrated. And there's a chance the national economy will soften in the last half-year. That could hurt light plane sales.

Bright spot: the military will continue buying off the shelf for liaison use and personnel travel. And the forthcoming military competition for lightplanes could help.

Even so, it looks like lightplane unit sales will be lower than in 1949, while value (because of higher prices) will be up.

Forecast for 1950: 3300 planes valued at $17 million.

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ENGINE PRODUCTION this year will continue its dizzy climb, but the curve will flatten. Horsepower output in 1949 was up about 90 percent over the preceding year. It won't go up at that rate this year, but still engine manufacturers should show big gains.

Reason isn't hard to find: increasing power of jet engines (page 30). This technological progress is a big bargain for the customer. After volume production on a jet is underway, the jet costs about the same as a piston engine. The customer gets more power for his money.

Engine output now is about 50–50 between jets and piston engines, as far as units go. This year, a third type may enter production, the turboprop. This would tend to push the horsepower total higher.

Forecast for 1950: total horsepower, 75-80 million, valued at $636 million.

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AIRLINE REVENUE is the most difficult of all to predict. At one time it was a matter of average fare-per-mile and total revenue passenger miles. But the fare picture has clarified little in the past year.

Still, it looks as if airline revenue will continue to increase. Last year, nearly everybody missed on forecasting revenues. No one foresaw how fast passenger revenue would increase. The lift in passenger revenue miles was expected with the advent of the skycoach.

What wasn't expected was that regular fare travel would increase the way it did.

It would look like 1949 gains in regular-fare air travel were merely recouping 1947's unusual declines.

Forecast for 1950: total revenue passenger miles for trunk, feeder and international lines, 10,600 million. Total revenue, $780 million.

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AIR COACH should boost the revenue passenger miles this year at the expense of the rising revenue curve—the development that was expected last year. We pointed out then that 1949 would see a race between low fares and increased miles flown. It looks like the increased traffic overcame a lower average fare resulting from the mixture of regular and special fares.

Transcontinental coach fares by certificated carriers haven't had a chance to prove themselves. Traffic so far is disappointing. But remember, it started in the winter. Trial period for American and TWA coach service expires in December. Some other current coach fares come up for review this summer.

CAB is unlikely to authorize many new coach services. It may even cut back a little on present services in highly competitive areas. Nevertheless it will not kill its coach experiment by refusing to renew all authority expiring this year.

An economic slide would hurt the airlines. But coach fares would cushion the blow. That would prove their worth to everybody once and for all.

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TRANS-ATLANTIC TRAFFIC will be better than ever this year. Most of it, of course, will be due to Holy Year travel from this country. In recent years, foreign carriers have been getting an increasing share of trans-Atlantic travel (page 123). The Holy Year traffic might halt that trend.

Another boost to trans-Atlantic travel is the fare-and-a-tenth round trip adopted by IATA. This ends March 31. If it proves a good traffic-builder, it will furnish powerful ammunition for an assault on the year-around fare structure.

But CAB still opposes any general lowering of rates. It wants to hold the line on mail pay. So, mail pay increases this year will be few.

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HELICOPTER PRODUCTION will mark time this year. Use of helicopters in agriculture has not grown as fast as anticipated. Nevertheless, many observers feel the copter is better for agricultural use than present fixed wing craft.

What copter manufacturers are waiting for is the transport market (page 98). They have some time to wait. CAB is unlikely to decide either the New York case or Los Angeles Airways' passenger application in time to help production this year. Meanwhile, AF and Navy orders for transport-type copters give manufacturers experience, commercial aspirants something on which to base plans.

Forecast for 1950: 100–110 helicopters delivered.

Forecast Box Score

Last year, in its Feb. 28, 1949 Inventory of Air Power, AVIATION WEEK inaugurated an annual Forecast of aviation business conditions. The following comparison shows the results. The personal plane sales forecast in 1949 was based on the prediction of the Personal Aircraft Council of the Aircraft Industries Assn.

	1949 Forecast	1949 Performance
Military shipments	35 million lb., 3000 planes	29,737,000 lb., 2500 planes
Military airframe payments	$1 billion	$663 million (nine months only)
Total manufacturing revenue	$1.4 billion	$1.7 billion
Transport plane sales	155 valued at $120 million	151 valued at $104 million
Personal plane sales	6000 valued at $30 million	3400 valued at $16.5 million
Engine shipments	40-45 million hp.	46.3 million hp.
Engine shipments value	$400 million	$360 million (nine months only)
Airline revenue passenger miles	8,550 million	8,800 million
Airline revenue (passengers, cargo, mail)	$650 million	$696 million
Helicopter sales	150-175	170 (approx.)

AVIATION CALENDAR

Feb. 27 Mar. 3—Spring meeting, American Society for Testing Materials. Hotel William Penn Pittsburgh

Mar 1-2—Louisiana Aviation Conference, Washington Youree Hotel Shreveport La Harold J Bryant Shreveport Chamber of Commerce, chairman

Mar 1-2—NFPA committee on aviation and airport fire protection, Hotel Severin, Indianapolis

Mar 6-8—Sixth annual Fourth Region non-scheduled operators meeting and second annual Agricultural Aviation Conference, Hotel Texas Fort Worth

Mar 6-9—47th annual meeting, American Road Builders Assn Netherlands Plaza Hotel, Cincinnati

Mar 6-9—Annual convention, Institute of Radio Engineers, Hotel Commodore, New York City

Mar 24—Fifth annual flight propulsion meeting, sponsored by the Institute of the Aeronautical Sciences, Carter Hotel, Cleveland

Mar 28-31—National Plastics Exposition, sponsored by Society of the Plastics Industry Navy Pier, Chicago

Mar 30-31—Sixth annual helicopter forum, sponsored by the American Helicopter Society and the Institute of the Aeronautical Sciences Ben Franklin Hotel, Philadelphia

Apr 4-6—Engineering and Maintenance conference Air Transport Assn, Hotel Continental Kansas City

Apr. 4-8—National Production Exposition, sponsored by the Chicago Technical Societies Council Stevens Hotel, Chicago

Apr 10-12—Annual convention American Society of Lubrication Engineers, Hotel Statler Detroit

Apr. 16-20—Annual business meeting, American Assn of Airport Executives, Neil House Hotel, Columbus Ohio

Apr 17-19—1950 aeronautic meeting, Society of Automotive Engineers Hotel Statler New York City

Apr 24-26—Airport Operators Council, third annual meeting, Hotel Carter, Cleveland

May 5-6—Midwestern conference on fluid dynamics and the national meeting of the American Physical Society fluid dynamics division, University of Illinois, Urbana

June 2-25—Ninety Nines 1950 convention, Ft Chuk Guest Ranch Brackettville Tex

June 10-13—National Aeronautics Assn., annual convention Hotel Statler St Louis, Mo

June 26-30—53rd annual meeting American Society for Testing Materials ninth exhibit of testing apparatus and related equipment, Chalfonte-Haddon Hall, Atlantic City, N J

July 30-Aug 13—17th National Soaring Contest Grand Prairie Tex.

PICTURE CREDITS

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U. S. Air Power Not Adequate for Needs

Economy cuts USAF strength and delays Europe's arming.

American air power emerged from World War II as the most dominant weapon the world has known. Five years later it is rapidly falling into second rate status because of presidential congressional and military disagreement over budgets roles and strategy.

Chief concern to proponents of air power strategy, however, is the inconsistency of Secretary Johnson's "economies." Budget proposals sponsored by the Defense Secretary arbitrarily lop 25 percent from USAF estimates and 40 percent from Navy Bureau of Aeronautics estimates of what is considered necessary to maintain reduced forces in being effectively modern.

By 1955 (seen by defense planners as likely world showdown date), if current economy trends continue, the Air Force group strength will be comprised of equipment two thirds obsolescent. Navy aviation will be in even worse shape.

► **International Status**—This is in the face of an international situation which continues a steady deterioration in Asia and Europe. Realistic independent reports support warnings of Air Force Secretary Symington and National Advisory Committee for Aeronautics Secretary John Victory about the rapid growth of Russian air power. Such reports contradict statements of Defense Secretary Johnson concerning the relative "readiness" of U. S. armed forces.

Hope for early effective arming of the Atlantic Pact nations seems remote. Plans for participation by U. S. military services still in the early formative stages indicate that U. S. planes and equipment would eventually form a large part of the U. S. contribution, along with technical training in the United States of allied military personnel.

Another minus factor in the situation is a slowdown on expenditure of the $1 billion already appropriated for the current fiscal year for European armament under the pact.

► **Current Strength**—National concern mounts regarding ability of U. S. air power to meet and defend the U. S. from an air attack. Two years ago, based upon the Finletter report and subsequent congressional authority, the Air Force began building toward a 70-group program. Fifty-six groups, had been activated but not completely equipped when USAF was ordered to cut back to 48.

This leaves USAF in fiscal '50/'51 with 3300 first-line combat aircraft comprising 15 heavy bomber groups, 27 tactical light bomber and fighter groups and six troop carrier groups.

Navy's operational force is cut below what it considers is its safe minimum strength. Today it has 13 carriers operational and 3368 combat aircraft of all types (not including shore establishment craft), 1212 being "first line."

In proposals put forth for fiscal '51, Navy would be required to reduce its heavy carrier strength to seven and its light and escort carriers to three. Carrier combat groups would be reduced from 14 groups to nine, anti-submarine escort carrier squadrons would shrink from eight to seven, and patrol squadrons from 30 to 20. The Marine air arm is cut from 23 squadrons to 12. End result of Naval aviation cutbacks is an aircraft in-commission reduction of more than 1000 planes.

► **Replacements Hit** — Number-wise, USAF will still operate substantially the same number of aircraft in 1950 as in 1949.

But aircraft replacement rate is slashed nearly 25 percent below USAF estimates of what it needs for modern air war. Looking ahead (if the present trend continues) this means an obsoles-

Air Force and Naval Aviation Appropriations

AIR FORCE		BUREAU OF AERONAUTICS
$186 252 294 (1) (3)	1940 (After Supplementals	$151 489 000
$3,892,769 570 (3)	1941 "	982,320 000
$21,952 516,861 (3)	1942 (After Recessions	6,989,444 100
$11,316,898 910 (3)	1943 "	4 736 498 981
$23 655 481 000 (3)	1944 "	5 307 806 058
$1 610 200 000 (2) (3)	1945 "	2 551 615 679
$100 (3) (3)	1946 "	796 921,000
$1 199 500 000	1947 "	870 760,000
$829,272,100 (4)	1948	749 000,000
$1,504,911 000 (6)	1949 "	900 000 000 (7)
$4 119 386 000 (8)	1950	1,038,210,000 (9)
$4 400 000 000 (10)	1951 (Budget Requests)	1,156 796,000 (11)

(1) In addition contract authorization of $71 [illegible] 188 was provided.
(2) In addition $11 000 000 000 was authorized from prior year funds.
(3) Original program approved by Congress was $44 [illegible] later reduced to $1 410 000 000 in third revision after VJ day. Except for token cash appropriation of $100 million made from carryover of prior year appropriations.
(4) In addition contract authorization of $410 000 000 was approved.
(5) From total appropriations to AAF by Congress during fiscal years 1940-1946 inclusive, AAF saved approximately $9 [illegible] 000 000. Of this amount $15 500 000 000 was recovered into the Treasury and $6 300 000 000 was transferred to other War Department funds.
(6) A 1948 supplemental appropriation provided $685 100 000 each out of total shown. In addition contract authorization of $1 687 000 000 was approved.
(7) A 1948 supplemental appropriation provided $315 000 000 out of total appropriation shown. In addition contract authorization of $585 000 000 was approved.
(8) In addition contract authorization of $1 582 [illegible] 000 was approved plus $306 275 217 contract authorization held over from fiscal year 1949.
(9) In addition contract authorization of $476 546 000 was approved.
(10) In addition contract authorization of $610 000 000 was asked plus $720 [illegible] 000 contract authorization held over from fiscal year 1950.
(11) In addition contract authorization of $475 400 000 was asked plus $124 [illegible] 000 contract authorization held over from fiscal year 1950.
NOTE: Air Force appropriations for years before 1950 did not include functions previously performed for Air Force by War Department, but now part of Air Force.

cence of one third of USAF group strength by 1955.

Naval replacement of obsolete aircraft proposed in fiscal '51 is worse, with less than 60 percent requested in replacement estimates

The Air Force is considered the "have-not service" so far as facilities are concerned. Much of its long-range efforts is aimed at relieving this situation. With few exceptions, its facilities are temporary expedients based upon rapid wartime expansion. Where Army and Navy simply improved or expanded existing facilities, the Air Force many times had to do the job from scratch. Today, Air Force finds itself facing critical shortages in housing not only for its personnel but for its great variety of projects.

▶**Navy Status**—Navy feels a loss of prestige. Strategy revision has passed the intangible military quarterback designation of "first line of defense" to USAF. Fund curtailment because of that shift in strategy has left the old line Navy heads disconcerted to the point of being afraid to let the right hand know what the left hand is doing. Although still smarting, Navy is slowly regaining equilibrium.

▶**National Policy**—It has always been U. S. national policy as a democracy not to fight unless attacked and, therefore, not to approach a state of total readiness for war in peacetime.

As a result, U. S. relies upon research and development in the broadest sense so it may "know a little about everything."

This accounts primarily for this nation's present strategy—reliance upon long-range bombing and placement of USAF in the stellar role of "quarterback."

That's why the Army strives for aerial mobility.

That's why the Navy is forced to put its air arm primarily to anti-submarine warfare and maintaining the sea lanes to the U. S.

▶**Strategic Plan**—The Joint Chiefs of Staff has the Strategic Air Command under its direct control. It can order B-36, B-29 and B-50 groups to any point in the world at the first sign of hostilities. Theoretically this gives the nation a retaliatory weapon of sufficient stature to command international respect.

Realistically, USAF of necessity would have to send its bombers unescorted to targets and face high rates of attrition. Intelligence indicates a high degree of development in anti-aircraft weapons by the Russians.

There are no escort fighters today or in prospect that have the range capability of the B-36. Jet interceptor fighters are short-ranged. Designation of "long range" applied to jet fighter craft is wishful. USAF and Navy are evidencing new interest in propeller driving power plants, but the fact remains that the turbojet is currently the only production engine capable of providing adequate dash-speed fighter power for combat use.

Late this summer the Air Force will test the feasibility of attaching Republic F-84Es to either wing tip of the B-50 and later the B-36 to provide fighter escort to targets. Preliminary study has indicated the problem is aerodynamically possible without appreciable loss of bomber capabilities.

▶**Tactical Status**—Air mobility and tactical support of ground troops is a sore point to both USAF and Army. Today, the Army is not air-transportable. Not a division of ground troops could be moved in its entirety 100 miles by air. Army is dissatisfied with USAF current tactical support of ground troops (one light bomb group assigned).

Techniques of support have changed with the advent of the jet fighter, but USAF tactics have not kept abreast. To counteract this inequity, Army has been charged by JCS with the establishment of a joint airborne center which will undertake to revise doctrines, tactics and techniques, and evaluate airborne equipment. Air Force points out it is forced to sketchy active support of ground troops because of budget limitations. New items of ground equipment are being manufactured with an eye to air transportability. Chief ground concern of Army is in convincing ordnance that "biggest" is no longer the prime requirement.

▶**Navy Role**—Navy is turning to its new prime role of anti-submarine warfare and open sea lanes for delivery of raw materials which are comparatively rare in North America. Emphasis in defense strategy of the Western Hemisphere has shifted from east-west to north-south. Panama Canal is no longer of first importance.

Naval aviation trend is towards heavier aircraft featuring long range, high-altitude characteristics. Carrier aircraft are being modified to withstand heavier deckloads as development trends continue toward bringing into being heavier carrier type planes.

Service Plane Designations

Rapidly changing missions and technology of USAF and Naval aircraft require accompanying changes in aircraft designation. Both services have distinctive nomenclature for aircraft and their civilian counterpart yet another. Despite this fact all three system follow essentially the same principle of identification.

The Aircraft Committee of the Munitions Board is currently devising a joint nomenclature for all military craft. Announcement of the joint program is expected late this year. Meanwhile, the following military systems are in present use.

▶**Air Force**—Air Force designates the mission, type and model number of its aircraft by the following letters: **B**, bombardment; **C**, cargo; **F**, fighter; **H**, helicopter; **L**, liaison; **R**, reconnaissance; **S**, search; **T**, trainer; and **X**, research. In addition, **A**, amphibian, is used as a prefixe to other mission designations but not alone. These letters are also used in combination to indicate dual missions, such as **TF**, trainer-fighter; **SA**, search-amphibian, **RB**, reconnaissance-bombardment, and **LC**, liaison-cargo.

Prototypes are designated by an **X** prefix and production models by alphabetical suffixes, such as F-80A, F-80B, F-80C, etc. Suffix letters normally indicate a lack of complete interchangeability of parts, usually the engine, or changes which affect the performance, maintenance or tactical use.

▶**Navy**—The Navy designation system is similar except that a manufacturer's identifying letter is added as well as detailed suffixes indicating special missions. Navy aircraft type designations are **VA**, attack, **VF**, fighter, **VH**, helicopter, **VP**, search, **VT**, trainer, and **VR**, transport.

Currently active aircraft manufacturers are identified as follows: **B**, Beech, Boeing, **C**, Curtiss, **D**, Douglas, **E**, Piper, **F**, Grumman, **G**, Goodyear, **H**, McDonnell, **J**, North American, **M**, Martin, **O**, Lockheed, **Q**, Fairchild, **R**, Ryan, **S**, Sikorsky, **U**, Chance Vought, **Y**, Convair.

In addition, a large number of suffixes are used to indicate special modifications to otherwise standard aircraft types: **A**, amphibian, **B**, special armament, **C**, carrier version of non-carrier aircraft, **D**, drone control, **E**, special electronic gear, **G**, search and rescue, **H**, hospital, **J**, target tow, **K**, target drone; **L**, searchlight, **M**, weather reconnaissance, **N**, night operating aircraft, **P**, photographic; **Q**, countermeasures equipment, **R**, transport, **S**, anti-submarine warfare equipment, **T**, training, **U**, utility, **W**, special search, **Z**, administrative.

Additionally, Navy combines numerals and letters to indicate separate types and models by designating the first numeral as the model designation and the second numeral as a change in the same manufacturer's model, as in F9F and F9F-5.

▶**Research Program**—Greater emphasis is being and will be placed by both USAF and Navy on urgent need for more search and detection radar equipment. Most important research in electronic field is in anti-detection. Highly classified research into absorbtion of the electronic impulse is making some headway. This would, in effect, permit aircraft to escape enemy radar.

Weapons and weapon utilization, also, are finally moving forward after a long time lag in design problems. Foremost of these, of course, are air-to-air guided missiles and homing devices. U. S. supersonic research in these fields finally is beginning to surpass captured German prototypes. The Air Force continues to experiment with 60-cal. guns with which it hopes to replace the familiar wartime 50s. These will be electronically fired by automatic "on target" devices.

Power plant research is turning with renewed and heavy emphasis to propeller-driving gas turbines since Navy-sponsored research has shown Navy claims for the propeller not only valid but conservative in high sub-sonic plane designs.

▶**Budgets**—Congressional sources predict that USAF budget (at $4.4 billion, highest of the three services) will be passed almost without change, while Army and Navy may suffer further in the interests of economy.

Within its limits, the defense budget contemplates continued development of industrial mobilization planning and continued accumulation of strategic and critical materials. It places emphasis on research and development activities in an attempt to make this nation ready for anything on any and all fronts.

Estimates are that fiscal '50 will see a total expenditure of $1.7 billion for aircraft procurement. Administration proposals include $2.1 billion for fiscal 1951 for the purchase of approximately 2300 aircraft.

Budget recommendations call for new contracts to be made in 1951 for a total of $2 billion, which include $851 million of 1950 authorization held in reserve against aircraft requirements to be contracted for in 1951. Another $3.3 billion contracted for in fiscal 1950 and prior years will be earned forward into 1951.

This makes a total of $5.3 billion of complete aircraft to be delivered and paid for in 1951 and subsequently.

Group Strength Classification

USAF currently is comprised of 48 groups and 13 separate supporting squadrons. Its civilian components, the Air Force Reserve and Air National Guard, are organized into 27 groups and 25 base wings, respectively. In round numbers USAF is operating 8800 aircraft of all types while USAFR and ANG operate an additional 3400.

Strength of squadrons and groups comprising these components are based upon a group's mission and type of craft employed therein. Today, group strength classifications are:

Type of Craft	Squadron	Group
Heavy Bomber (B-36)	10	30
Medium Bomber (B-50, B-29, etc.)	10	30
Light Bomber (B-45, B-26, etc.)	16	48
Troop Carrier, VH (C-54, C-74, etc.)	12	36
Troop Carrier, LT (C-28, C-47, etc.)	16	48
Fighter (F-86, F-80, F-84, etc.)	25	75
Tactical Recon (F-80, A-26, B-45, etc.)	18	54
Strategic Recon (B-29, B-50, etc.)	12	36
Liaison (L-5, L-15, etc.)	16	0
Tow Target (A-26s, etc.)	9	0
Rescue (SA-16, SB-29, C-82, B-17, H-21, etc.)	36	0

USAF Aircraft Strength is Down

Stringent budget has pushed Air Force to long-range research and development in lieu of 70-group plan.

In its third year of autonomy the U. S. Air Force assumed full stature as the "first line of defense" by topping sister services in 1951 budget estimates ($4.4 billion).

It is candidly speaking out for a 70 group air force, contrary to Administration policy.

It is continuing major emphasis on intercontinental bomber strategy.

Although 2324 planes were purchased during 1949 for a total airframe weight of 33.5 million lb., USAF aircraft strength fell drastically. Approximately 3000 planes of all types had to be drawn from storage.

At the close of 1949, the Air Force had on hand 17,600 planes of all types, as against 21,100 a year ago. Of aircraft on hand, 8900 are available for immediate use and 8700 are in storage. Of operational planes 3300 are combat aircraft and 5600 non-combat equipment.

Of aircraft in reserve 4700 are combat aircraft of all types and 4000 are non-combat.

▶**B-36 Main Star**—Most significant event of the year was public airing of the B-36 controversy. It ended in a renewed vote of confidence in USAF strategy by Congress. Later, a decision was reached to hold the B-36 as nucleus of U. S. air strategy at least until Jan. 1, 1955.

Of equal significance politically, was success of the Berlin Airlift. It gave the armed forces invaluable lessons in tactics and mechanics of air mobility, and Europeans received unforgettable lessons in democracy from the emergency blockade-busting operation.

▶**Types Selected**—Following an erratic postwar sampling of an impressive array of fighter and bomber types, USAF has chosen a few models through comparison evaluation for major production during the remainder of fiscal 1950 and through fiscal 1951.

In the fighter field, transition to jet fighter groups is near completion with 19 jet fighter groups (four were converted to jet in 1949) now in operation and four National Guard groups receiving deliveries of jet fighters. Types currently in squadron use include the Lockheed F-80 series, Republic F-84 series and North American F-86A.

Yet to be assigned to squadrons as soon as production from fiscal 1951 funds permits are the F-89A, F-94B and F-93.

▶**Design vs Performance**—USAF in the past has indicated displeasure to airframe and engine manufacturers over design specifications in comparison to actual performance of prototype. The F-94A was found deficient in speed at altitude and time it took to climb to altitude.

F-94B version with heavier thrust J-48 engine, now meets USAF requirements for radar search, night and all weather capabilities. Not designed to meet penetration requirements, it is scheduled for short-range search and intercept needs. Emphasis on development of other night fighter types will continue during the year.

The F-89A is in production and first model off the line is scheduled to

fly early in fiscal 1951. White hope of USAF's all-weather requirements, F-89B version will feature more powerful engines.

▶**Penetration Fighters**—The XF-88, XF-90 and YF-93 meet current "minimum" needs of USAF for penetration, as do the F-84E and F-86D. Production procurement of all is planned in fiscal 1951 with deliveries of F-88s, F-90s and F-93s scheduled late in calendar 1951.

In aircraft design, goal of USAF development remains aimed at longer range, greater speed and higher altitude.

Currently, USAF has in production only one heavy bomber, the B-36. Boeing's XB-52 is scheduled in fiscal 1951 funds for prototype delivery in 1952 but may be held off in favor of a sweptwing, turboprop version of the B-36, capable of 500-mph speeds at 50,000 ft.

▶**Medium Bomber**—Meanwhile, improved wartime bombers, the B-29 and B-50, remain the backbone of USAF's medium bombardment groups. These will be augmented during calendar 1950 by Boeing B-47 jet bombers for the Strategic Air Command.

Several jet-powered light bombers have been developed for light bombardment and ground support activities. But the North American B-45C remains the only aircraft in production for replacement of the piston-engine B-26 and will be assigned to tactical ground support.

▶**Trainers Lacking**—USAF and Navy are concerned about the lack of adequate single and twin-engine trainers. Most current trainers are modernized versions of wartime types with inadequate capabilities. Pressing need of both services is for an economical twin-engine trainer to fill a dual role of pilot trainer as well as light utility transport.

Joint plane design group established by the air committee of Munitions Board is currently working out details of specifications for a design competition. It will be announced late this spring.

▶**Evaluation Scheduled**—USAF's North American T-6G single-engine trainer and the Navy Beech SNJ can meet normal peacetime training requirements. But neither craft is considered wholly adequate by its respective service.

A new single-engine evaluation competition is also scheduled for several prototypes such as the North American T-28 and Fairchild T-31. A quantity production contract from fiscal 1951 funds will be the winner's prize award.

During fiscal year 1949 Air Force research and development studied methods and techniques in the conduct of intercontinental air warfare under Project Rand. Studies are aimed at bringing the scientific viewpoint to bear upon normal military problems connected with the successful performance of the Air Force mission.

▶**Research Programs**—In basic research Air Force has emphasized the following programs (in descending order according to research and development funds expended):

Program	Cost
Powerplant	$30 million
Aircraft	25 million
Electronics	25 million
Guided missiles	15 million
Laboratory equipment	10 million
Armament	10 million
Equipment	10 million
Facilities	8 million
Special weapons	7 million
Propeller	6 million

Less than $5 million each was expended on Air Engineering Development Center, all weather aeromedical, engine shops, flight test, materials, engine standards and climatic hangar study projects.

▶**Helicopter Program**—USAF, Army and Navy place heavy emphasis on helicopter development. The improved Piasecki H-21 quantity procurement following a recent competition represents USAF's "go" signal in helicopter fields.

Both the USAF and Army are enthusiastic over design performance estimates of the Piasecki XH-16 which is expected to make its first flight in mid-1952. It will incorporate two-speed superchargers, all-weather flight capabilities, automatic pilot and instrumentation for blind flight.

Heavy-duty XH-17 (flying crane) helicopter is under development and is scheduled for flight in 1953. Companion development of large rotor blades and ramjet power systems are currently bogged down by high fuel consumption and noise level. Army, meanwhile, continues pressing for development of a one-place lightweight helicopter to perform quick, low-altitude reconnaisance and liaison missions.

▶**Propulsion Program**—In aircraft propulsion, USAF will concentrate limited funds on turbojet engines and rocket assisted takeoff (RATO) units for all new combat fighter and bomber design.

Research emphasis is also placed on decreasing fuel consumption, and minimizing the amounts of critical materials needed in jet engine construction. The piston engine, however, by virtue of its economical fuel consumption, reliability, flexibility, and high altitude performance remains the foremost propulsion unit for heavy bombardment aircraft. The improved R-4360 engine, in its forthcoming compound version is in production for USAF.

AMC's Aero Medical Lab tests with prone pilot position have been so successful that design requirements are being compiled for a prone position experimental fighter. These will be submitted to manufacturers for cost estimates.

Indicative of emphasis placed by USAF on long-range research and development activities, in lieu of building to 70 groups, is the new post of deputy chief of staff for research and development, plus prior elevation of USAF field office for atomic energy to command status and redesignation to Special Weapons Command.

▶**AEDC Urgency**—The Air Engineering Development Center, $100 million segment of the $256 million unitary wind tunnel program authorized by Congress, will have a tremendous impact upon the technical development and subsequent evaluation of air weapons. Urgency of engine research and aircraft design problems will cause AEDC to be ready for full operation in 1955, ahead of its present time table.

While technological progress has pushed aeronautical science to high levels, tactical application of derived performance has not been comparable. Air strategy is still sketchy and impractical.

This deficiency does not lie exclusively on those charged with tactics but is equally a problem for those engaged in electronics and weapons research and development. For the most part, weapons currently in use are interim, or because of experimental nature are not in quantity production. As a result air strategy for battle is, as yet, not practicably crystalized.

▶**Ground Support**—Air strategy and tactics are of vital concern to the Army which is striving for complete air mobility. Similarly, Army is dependent upon USAF for tactical support of its ground troops. In the former progress has been sufficiently stable; in the latter Army has lodged a bitter complaint with the JCS.

While long-range bombing retaliatory strategy is the nation's plan for holding off all comers, Army strategy has had to be drastically revised. This came with USAF's decision to hold to 15 bomber groups and 23 light bombardment and fighter groups under presidential orders for a 48-group ceiling. Rift in USAF-Army joint plans concept is result of Air Force decision to maintain only one group for tactical air support activity.

▶**ANG Role**—Air Force claims tactical air power isn't lagging in relation to assigned missions and "available appropriations." Additionally, USAF claims Air National Guard strength set for immediate mobilization at the first outbreak of hostility consists entirely of groups equipped for air defense and support activities of land and sea activity. At an M-Day, USAF sees a possible 80 percent of total combat air forces ready to do battle for land, sea personnel.

Army isn't convinced and apparently JCS wasn't too sure because it changed AFF with establishment of an airborne center which will promote airborne doctrines, revise tactics and evaluate planes and airborne material. Trend for development of aircraft for tactical air purposes will be increasingly evident as the year advances.

Navy's New Role in Air Power

Anti-submarine job shifts Naval interest to heavy long-range bomber types; turboprop research pushed.

Its assignment to anti-submarine warfare crystallized the Navy has moved to a complete revision of strategy, a regrouping of fleet units in keeping with a curtailed budget, and heavy emphasis on quality instead of quantity in its air arm.

Resultant strategy of the Naval air arm has settled to development of heavy fighter-bomber types with a definite shift in air research from speed to long-range characteristics. Where USAF pursues an eventual all-turbojet fighter force by 1955, Navy presses research toward development of the turboprop engine.

▶**High Speed Props**—Decision of Navy to push turboprop research is based upon a recent engineering study confirmed by NACA which not only validated Navy's evaluation study on high speed propellers but labeled claims as conservative.

Coordination of the "new" Naval air power as complementary to USAF, will give this nation a theoretical all-around military air potential when tactical mobility of fast carrier forces and extreme range carrier bomber fighters are added to the B-36 concept.

▶**Scaling Down**—Expansion of Naval aviation originally planned for fiscal '49 was scrapped due to budgetary revisions. Fiscal '50 has continued the scaling down of Naval air strength. In June, 1949, the air arm consisted of 5590 fleet combat, combat support and shore establishment craft, 2142 USNR craft and 5524 aircraft non-operational and in storage. At the beginning of 1950 this force had shrunk to 4900 fleet combat, combat support and shore establishment craft, 1900 USNR craft and 550 aircraft non-operational and in storage.

Scheduled for still further curtailment in fiscal 1951, Navy has asked for funds to permit operation of only 4367 combat and combat support planes plus 1840 planes for reserve activities. This would place approximately 500 currently operational aircraft in storage for a total of 6200. These would be withdrawn through fiscal '51 as replacements to offset a proposed 40 percent reduction in procurement of modern replacement aircraft.

▶**769 Planes**—Estimates for 1951 contemplate Navy aircraft procurement of $690 million including $124 million contract authorization which was granted but not obligated in 1950. If approved, this program will provide for 769 new aircraft with an airframe weight of 8.2 million lb.—1.2 million lb. airframe weight gain over fiscal 1950's estimated total of 6.9 million lb. for 768 planes.

Navy carrier groups are undergoing reductions, with a total planned fiscal 1951 reduction from 14 groups to nine. Anti-submarine escort carrier squadrons will be cut from eight to seven and patrol squadrons from 30 to 20. The Marine air arm is being cut nearly in half from 23 to 12 fighter squadrons.

▶**Carrier Modification**—While actual operating strength is drastically reduced, Navy continues modification of its aircraft carriers to meet the need of new heavier carrier planes. Several carriers of the Essex class are being equipped with strengthened flight decks, increased capacity catapults and gasoline handling capacities.

Since Congress and Defense Department are designating the major share of the total budget for the U. S. Air Force, Navy is concentrating on prototypes and service test quantities of planes so that it can "be ready for expansion." Outcome of evaluation tests of the new Convair XP5Y-1 will determine Navy's course on establishing a water-based Naval air force to supplement carrier groups. Flying-boat fighter Skate development will also be resumed in fiscal 1951 to prove out water-based trend.

▶**Aircraft Contracts**—In current fighter types the McDonnell F2H-2 and Chance Vought F6U-1 are the most recent to enter service use. The Navy is not wholly satisfied with the existing F2H-2 and does not class the F6U-1 "first line."

Out of fiscal '50 funds Navy has ordered 140 F2H-2 Banshee fighters equipped with droppable wing-tip tanks. Later version Banshee is due for heavier thrust engines (replacing Westinghouse J-34) to provide improved combat effectiveness and all-weather capabilities. F2H-2 is now undergoing night evaluation tests.

• **Douglas F3D** now entering service use is rated as Navy's top all-weather fighter and 70 F3D-2s have been ordered from fiscal '50 funds. Although current version has neither speed nor rate of climb of the F2H or F9F, production schedules for fiscal '51 include F3D-3 modification providing greater speed, rate of climb and combat ceiling.

F3D-3 is scheduled for procurement from fiscal '51 funds and will be available for service use in 1952. In performance the F3D-2 compares with USAF's F-89. Douglas was also given contractual authority for 53 more AD-3s.

• **Grumman** Aircraft has received orders for 242 F9F-4 and 5s. The F9F-4, which will be powered by late model Allison J-33 engine, will extend serviceability of the current fighter. The F9F-5 version uses the Pratt & Whitney 6250 lb. thrust (8000 lb. thrust with afterburner) J-48 engine expected to provide more speed, shorten climb time and raise combat ceiling considerably.

Grumman was also awarded a continuance contract for 72 AF anti-submarine attack planes. Previously 23 were ordered from fiscal '49 funds. The AF contract will be divided equally between the AF2W and AF2S. Grumman's XF10F, a radical new type which came off the drawing boards in 1947, is scheduled for flight early next year and is expected to go into service use some time late in 1952.

• **Chance Vought** aircraft division of United Aircraft has been awarded a contract for 60 F4U-5N night-all-weather versions of the piston-engine Corsair. Contract for XF7U-2 Cutlass, has been temporarily withdrawn from fiscal '50 schedules pending revision of propulsion costs. It is likely to begin service use late in calendar 1950 and will use heavier thrust engines than XF7U-1, plus droppable wing tip tanks which will provide for an increased range to bring it to full Navy performance expectations.

• **Lockheed** aircraft received an order for 45 P2V-5 Neptune patrol bombers and 10 Navy TO-2 versions of the USAF two-place jet T-33A trainers.

• **North American** got a contract for 15 more AJ-1 three-engined attack bombers.

• **Glenn L. Martin** will build five P5M twin-engined flying boats from fiscal '50 funds.

• **Piasecki** was given a production order for five HUP seven-place helicopters.

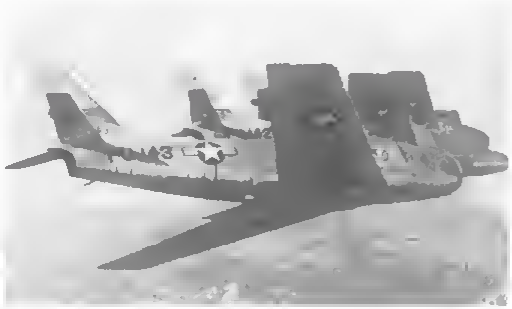
U. S. Air Force and Navy Aircraft

Manufacturer	Designation: Model	Designation: Name	Type	Crew	Cargo or bomb load (lb.)	Powerplant: Number and make of engines	Max. hp. or lb. thrust ea.	At rpm	Normal rated hp. or lb. thrust ea.	At rpm	At altitude (ft.)	Performance: Fuel capacity (gal.)	Max. speed (mph.)	At altitude (ft.)	Service ceiling (ft.)	Rate of climb (fpm.)	Weights: Gross weight (lb.)	Empty weight (lb.)	Dimensions: Span	Length	Height	Current orders	Remarks
Beech Aircraft Corp. Wichita, Kans.	45	Mentor	Trainer	2		1 Con E 185-8	205	2600				45	160	SL	17 300	1000	2850	1991	32' 10"	25' 10 4"	9' 7"		Bch prop. 88" dia
Boeing Airplane Co. Seattle, Wash.	XB-47	Stratojet	Bomber	3	20 000+	6 GE J-47-GE-11	5200		4800	7850			600+		35 000+	5000	125 000+	80 000	116'	108'		87	Wichita plant ... B-47A.
	B-50D	Superfortress	Bomber	11	28 000	4 P & W R-4360	3500		3000	2550	25 000	5000	400+		35 000	1500	164 500	80 000	141' 3"	99'	34' 7"	188	C prop. 200" dia.
	C-97A	Stratofreighter	Transport	3-5	8100+	4 P & W R-4360	3500	2700	2650	2550	25 000	7700	344	25 000		1542	150 000	73 518	141' 3"	110' 4"	38' 3"	60	HS prop. 200" dia.
	YL-15	Scout	Liaison	2		1 Lyc O-290-7	125		125	2600	SL	31	112	SL	15 000	528	2050	1500	40'	25' 2"	8' 6"	10	Sensenich prop.
Chance Vought Aircraft Div. United Aircraft Corp. Dallas, Tex.	F4U-5	Corsair	Fighter	1		1 P & W R-2800-32W	2300		1100	2800	26 000	234	470	27 000	42 800	4340	13 297	15 000	40' 11 7"	34 6 3"	14 9 5"	122	HS prop. 153" dia.
	F6U-1	Pirate	Fighter	1		1 We J-34 WE-30A			3000	12,500		700	550*		38 000+	7800	11 300	7500	32' 10"	37' 8"	12' 11"	30	Afterburner fitted.
	F7U-1	Cutlass	Fighter	1		2 We J-34 WE-32							600*			13 000	15 000	13 000					Sweptwing carrier fighter
Chase Aircraft Co. West Trenton, N. J.	YC-122C		Transport	2	1660	2 Wr R-1820-101	1425	2700	1275	2500		1000	245		26 100	1340	40 000	15 000	95' 8"	61' 8"	24' 3"	2	C prop. 150" dia.
	XC-123		Transport	2	3570	2 P & W R-2800-CB-16	2300	2700	1800	2500		1345	245		25 000	1250	54 000	30 000	110'	77' 1"	32' 8"	1	HS prop. 150" dia
Consolidated Vultee Aircraft Corp. San Diego, Calif.	B-36D		Bomber	15	10 000	6 P & W R-4360-41	3500	2700	2650	2550	35 000	21 000+	400+		40 000+	1000	358 000	145 000	230'	162'	46' 8"	170	C prop. 230" dia.
	XC-99		Transport	15	13,800	6 P & W R-4360-25	3000	2700	2650	2550	3500	21,116	300+		30 000	900	265 000	135 000	230'	182' 6"	57' 6"	1	C prop. 228" dia.
	XF-92A		Fighter	1		1 Al J-33-A-23	5400	11 750	3000	11 250	SL	596	725	40 000	40 000	12 000	15 000	5000	31' 4"	41' 4"	11 5 3"	1	60% delta swept wing.
	L-13		Liaison	3		1 Aro O-425-9	245	3250	245	3200	SL	118 5	115	SL	15 000	1080	2900	2070	40' 5 8"	31 9"	8' 5"	300	Bch prop. 102" dia.
	XP5Y-1		Patrol	11		4 Al XT-40-A-4	5100	14 300	4500	14 300	SL	7700	382	35 000	40 000	5500	140 500	80 000	145'	132'	46'	2	AP prop. 180" dia.
	T-29A		Trainer	3		2 P & W R-2800-97	2400	2550	1800	2600	5600	1000	306	14 300	20 000	1470	40 000	29 000	91' 9"	74' 8"	26 11"	46	HS prop. 157" dia.
Douglas Aircraft Co., Inc. Santa Monica, Calif.	C-124A	Globemaster 2	Transport	5	50 000	4 P & W R-4360-20W	3500	2700	2650	2550	7500	11 100	305	12,000	22,500	760	175 000	95 787	173' 3"	127' 2"	48' 3"	66	C prop. 188" dia.
	AD-2	Skyraider	Attack	1	10 000	1 Wr R-3350-26W	2700		2500	2600	2800	380	360	3200	5600	1659	15 965	10 548	50' 1/8"	38' 10"	15 7"	600	18 versions built.
	F3D-1	Skyknight	Fighter	2		2 We J-34 WE-32			3000	12,600			542	20 000			22 000	14 700	50'	45'	15	28	Long-range carrier fighter.
Fairchild E. & A. Corp. Aircraft Div. Hagerstown, Md.	C-82-A	Packet	Transport	5	3812	2 P & W R-2800-85	2100	2800	1700	2600	7300	2614	218	17 000	20 000	900	54 000	31 248	106' 5"	77' 1"	26' 4"	220	HS prop. 152" dia.
	C 119(R4Q)	Packet	Transport	5	2700	2 P & W R-4360-20W	3500	2700	2650	2550	5000	2795	265	18 000	21 300	1110	74 000	38 329	109' 3"	86' 5"	26' 6"	204	HS prop. 180" dia.
	XC 120		Transport	5	2700	2 P & W R-4360-20	3500	2550	2650	2550	5000	2795	245	15 000	23 700	1100	64 000	38 174	109' 3"	82' 1 5"	26 1"	1	HS prop. 161" dia.
Grumman Aircraft Engineering Corp. Bethpage, L. I.	AF-2		Attack	3		1 P & W R-2800-34W	2100										22 500	14 000				22	HS prop.
	F9F-3	Panther	Fighter	1		1 Al J-33-A	5000						600+				16 000	5000				417	F9F-5 has P & W J-48.
	SA-16A		Rescue	6		2 Wr R-1820-76	1400		1275			1000	270	15 000		1000	26 000	12 800	80	61' 4"	24' 5"	58	HS prop.
Lockheed Aircraft Corp. Burbank, Calif.	C-121A	Constellation	Transport	5	2844	4 Wr 749C18BD1	2500	2900	2100	2400	4400	5620	354	22 000		1200	105 000	60 500	123'	95' 3"	18' 9"	10	C prop. Max range is 5500 mi.
	F-80(TO-1)	Shooting Star	Fighter	1		1 Al J-33-A-23	5400	11 750				755	600		45 000+	5100	15 336	8215	38' 10"	34' 6"	11' 4"	1727	Takeoff over 50 ft. obstacle, 4370 ft.
	XF-90		Fighter	1		2 We J-34 WE-?	3000						M1 .?				20 000*		40'	56'	15'	2	USAF penetration fighter
	F-94A		Fighter	2		1 Al 400-D9	6000					548	600+				15 710	9835	38' 10"	40 1 5"	12' 8"	110	Takeoff over 50' obstacle, 2790 ft.
	P2V	Neptune	Patrol	7		2 Wr C18BA1	3250	2900	2300	2600	5800	2471	330	9400	22 300	1050	68 000	34 000	100'	77' 10"	28' 1"	278	Takeoff over 50' obstacle 3120 ft
	XR60-1	Constitution	Transport	12	6570	4 P & W R-4360-22W	3500	2700	2650	6550	22 000	9150	303	20 000	28 000	722	184 000	115 275	189' 1"	156' 1"	50' 4"	2	C prop. 200" dia.
	T-33(TO-2)		Trainer	2		1 Al J-33-A-23	5400	11 750	4600	11 750		820	600	27 000		5250	14 442	8084	38' 10"	37' 8"	11 8"	100	Takeoff over 50' obstacle 3530 ft.
Glenn L. Martin Co. Baltimore, Md.	AM-1	Mauler	Attack	1	7500	1 P & W R-4360-4	3000	2700	2500			400+	350+		27 000	2800+	23 100	15 000*	50' 1"	41' 6"	16 11"	149	C prop. 173" dia.
	XB-51		Bomber	3		3 GE J-47-GE-3			5400	7700		4000	685	35 000	45 000	6000	55 000	30 000	53	80	17		Ground attack type.
	JRM-2	Mars	Transport	11		4 P & W R-4360-4	3000		2500	2700	6000	13 220	238	15 000	17 570	652	165 000	80 311	200'	120' 3"	44' 7"	1	C prop. 200" dia.
	PBM-5A	Mariner	Patrol	5		2 P & W R-2800	2100		1700	2600	5000	3000+	160+		15,000+	370+	60 000	31 000	118	80	27 5"	36	C prop. Amphibious patrol bomber
	P4M-1	Mercator	Patrol	9		2 P & W R-4360-20			3250	2700	6000	4200	305	15 000	30 000	2500	80 000+		114	85		19	Range 3000 mi. plus.
	P5M-1		Patrol			2 Wr R-3350-30W			2700	2600	SL		270					50,000				2	New type hull.
McDonnell Aircraft Corp. St. Louis, Mo.	XF-88		Fighter	1		2 We J-34 WE-22	3600					1000	700	SL	45,000	5000	27 000	12 000	39' 8"	54 1 4"	17 3 2"	2	Range 1725 mi.
	FH-1	Phantom	Fighter	1		2 We J-30-WE-20	1600					375+	450+	SL	35 000+	4000+	12 000	6700	41	40	14	60	No wind SL takeoff 1134 ft.
	F2H-2	Banshee	Fighter	1		2 We J-34-WE-34			3000	12 500	SL	5000+	575+	SL	50 000+	9000+	16 000	2400	41' 9"	45	14 5"	179	Normal range 2000 mi. plus with tip tanks
North American Aviation Inc. Los Angeles, Calif.	AJ-1		Attack	3		2 P & W R-2800-34W	2400	2800									52 000	27 500				55	HS prop. Can carry atomic bomb.
	B-45	Tornado	Bomber	4	20 000+	4 GE J-47-GE-9	5200		4800	7700		4600	580*		45 000+	2000	82 000	47 000	89' 6"	74	25	139	Tactical radius 800 mi. plus
	F-86A	Sabre	Fighter	1		1 GE J-47-GE-3	5200	7700				400+	700	SL	40 000+	8000	13 000	10 000	37'	37'	14'	554	Tactical radius 600 mi. plus.
	YF-93A		Fighter	1		1 P & W J-48-P-6	6000								50 000		20 000	12 000	39'	44	15'		Flush inlets.
	T-28		Trainer	2		1 Wr R-1300-1	800		700			125	285	5000	25,500	2570	6100	5111	40 1"	32	12 8"	266	AP prop. 125" dia.
Northrop Aircraft, Inc. Hawthorne, Calif.	YRB-49A	Flying Wing	Bomber	5		6 Al J-35-15	5000										213 000		172'	53'	15'	1	Turbojet version of B-35.
	C-125	Raider	Transport	5	2500	3 Wr R-1820-99	1200	2500	1000	2500	SL		201	5300	15 200	1155	38 000		86	67'	21	23	C prop. 134" dia.
	F-89A	Scorpion	Fighter	2		2 Al J-35			4000	7700			600*		40 000*	5000	30 000+	12 000	50'*	50'*	15'	48	All-weather fighter
Republic Aviation Corp. Farmingdale, N. Y.	F-84E	Thunderjet	Fighter	1	4600*	1 Al J-35-A-17	5000	7800	5000	7700		500	630*	SL	42,000	4800	22 000	10,000	37	38+	12'+	1000	Some other model F-84s with ANG
	XF-91		Fighter	1		1 GE J-47	6400						M1			15 000		10,000	30	40'		2	Interceptor with inverse taper wings.
	XR-12		Recon	7		4 P & W R-4360-31	3500	2700				5000+	470	40,000	44 000+	1000	101,400	65,000	93'	129'	29'	2	C prop. 194" dia.
Ryan Aeronautical Co. San Diego, Calif.	L-17B	Navion	Liaison	1	20	1 Con E-185-3	205	2550	185	2300	SL	40 5	157	SL	15 000	850	2750	1859	33' 4 5"	27' 3"	8' 7 5"	163	H prop. 84" dia.
Texas Engineering & Mfg. Dallas, Tex.	T-35		Trainer	2		1 Con C-145-2H	145	2700	145	2700		26 5	145	SL	14 000	925	2000	1350	40 2"	21 6"	5 5"		Aer prop. ...

Italics—Aviation Week estimates

* Approximate
Aer—Aeromatic.
AP—Aeroproducts.
Airo—Aircooled Motors.
Al—Allison.
Bch—Beech.
C—Curtiss.
Con—Continental.
GE—General Electric.
H—Hartzell.
HS—Hamilton Standard.
Lyc—Lycoming.
P&W—Pratt & Whitney
SL—Sea Level
We—Westinghouse.
Wr—Wright.

1 Cubic feet.
2 Total ordered.
3 Internal
4 Includes four relief members.
5 Maximum bomb load is 84,000 lb.
6 Plus four GE J-47 turbojets at 5200 lb. thrust.
7 Total ordered all models.
8 Includes five relief members.
9 At normal rated hp.
10 Total ordered: contracts completed.
11 Plus 60 passengers.
12 Wet
13 Maximum weight is 29,000 lb.
14 Plus four JRM-1 similar but with Wr R-3350-8 engines of 2400 takeoff hp. each.
15 Plus two Allison J-33A-23 at 4100 lb. thrust each at 11,750 rpm.
16 172 with tip tanks, including 14 night fighters.
17 Plus one Allison J-33A-12 turbojet of 5100 lb. thrust at 11,750 rpm.
18 Sea level to 5200 ft.
19 At 38,000 lb. gross weight.
20 In prototype, production-plane engines not released
21 All models: 700 in service Jan. 1, 1950.
22 Plus four auxiliary rocket motors in tail.
23 With afterburner
24 Plus three passengers.
25 Number completed.

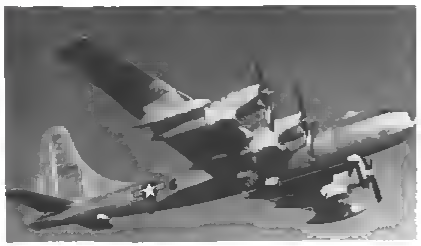


North American F-86A Sabre

Republic F-84E Thunderjet

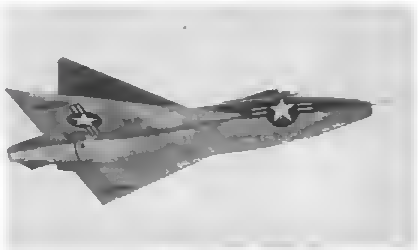
Northrop XF-89 Scorpion

North American B-45A Tornado

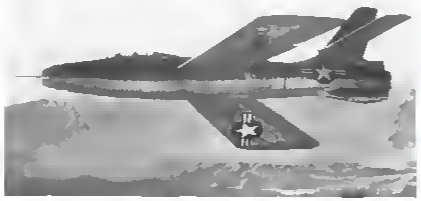


Boeing B-50D Superfortress

Boeing XB-47 Stratojet



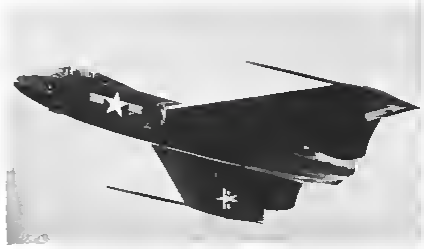
Consolidated Vultee XF-92A



Republic XF-91

Among U. S. Military Planes . . .

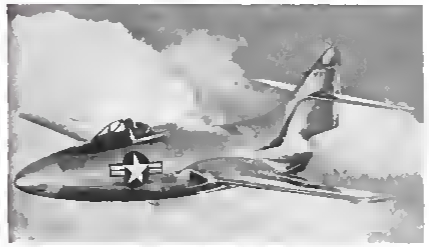
Douglas AD 2 Skyraider



Vought XF7U 1 Cutlass

Consolidated Vultee XP5Y-1

Consolidated Vultee B-36D (prototype)



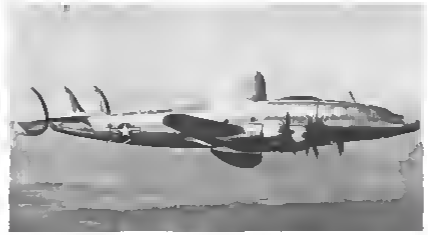
Grumman XF9F 2 Panther

Lockheed F-80B Shooting Star

North American YF 93A

Lockheed P2V Neptune

Among U. S. Military Planes . . .



Lockheed PO-1W

Martin P4M-1 Mercator

North American AJ-1

Martin XP5M-1

McDonnell F2H-1 Banshee

Douglas XF3D-1 Skyknight

Lockheed XF-90

McDonnell XF-88

Aircraft Industry Shows Production Gains

Manufacturers now stronger than at any time since war's end.

By Alexander McSurely

U S aircraft makers are beginning 1950 with two good years of production behind them and a third, even better, ahead As a result, company for-company, the industry is in better financial health than at any time since postwar adjustments put war-swollen aviation companies through the wringer

(In 1944 the aircraft industry ranked first In 1948 it ranked 44th In 1949 it was rated between 15th and 20th by the Department of Commerce)

▶**Sales Up**—Airframe, engine and propeller companies ran their 1949 shipments up to $1.7 billion, a dollar value increase of a quarter billion over 1948 sales. In terms of airframe pounds, deliveries totaled 36 4 million as compared to 34 5 million in 1948.

▶**Profit Higher**—Aggregate net profit for the aircraft industry for 1949 before renegotiation was expected to be slightly larger than in 1948 Since a major part of 1948 and 1949 fiscal year earnings are subject to renegotiation, there was no official interpretation to indicate the level of profits after renegotiation

A new Standard & Poor industry analysis for 1949 reports that of the principal companies Boeing, Convair Douglas, Grumman and Martin showed sharp improvement North American showed moderate gain, while Beech, Curtiss Wright, Lockheed and Republic showed declines and Northrop reported a loss The analysis forecasts for 1950 that Bell, Boeing Convair and United Aircraft appear headed for important profit increases Curtiss Wright, Fairchild Engine & Airplane Grumman, Lockheed and Martin will make moderate gains Douglas and North American will continue to show comparatively large earnings Beech is likely to show a substantial decrease and Northrop may again show a loss

▶**Floor Space**—An AVIATION WEEK survey of plant floor space in the aircraft industry showed an incomplete total of 56 406 752 sq ft for 1950 as compared to 52 958 218 sq ft for 1949

Military aircraft production continues to represent the bulk of the industry's output. In 1949 81 percent of the airframe pounds and 82 percent of the dollar value delivered was military

▶**2500 2600 Planes**—Aircraft Industry Assn estimated that 1949 military aircraft production exceeded the 1948 production by from 200 300 airplanes AIA put the 1948 total at around 2300 planes.

Civil airplane production meanwhile slumped numerically as 1949 showed production of about 120 airline transport planes, an additional 45 smaller twin engine executive craft and about 3400 personal planes In comparison 1948 showed about 260 commercial and executive and 7039 personal planes

▶**Minimum Levels**—Comparison of the

U. S. Aircraft Industry*

Company	Location	Plant Area Sq Ft	Plant Employment	1949 Sales[1]	Backlog[2]
Allison Div —GM	Indianapolis Ind.	4 000 000	8 700	NA	NA
Beech Aircraft Corp.	Wichita, Kan	1 000 000	2 100	$20 582 034[3]	$11 000 000
Bell Aircraft Corp.	Buffalo, N Y	600 000	4,600	11 300 000	34 500 000
Boeing Airplane Co.	Seattle-Renton, Wash.	4 680 264	18 793	176 813 510[4]	428 881 730[5]
	Wichita, Kan.	3 082 792	8 600		
Cessna Aircraft Co.	Wichita, Kan	518 960	518	12 738,000[6]	148 000
	Hutchinson, Kan	113 251	54		
Class Aircraft Co. Inc.	West Trenton N J	200 000	1 000	NA	NA
Consolidated Vultee Aircraft Corp.	San Diego, Calif	2,325 000	9 309	NA	328 932 800[6]
	Ft Worth Texas	3 471 000	16 775		
Curtiss Wright Corp.	Columbus Ohio	1 300 000	1 400	100 000 000	150,000 000
	Caldwell N J	800,000	4 400		
	Wood Ridge N J	2 300,000	8 300		
Douglas Aircraft Co.	Santa Monica, Calif	8 484 070	9 949	320 000 000[7]	500 000 000
	El Segundo, Calif	1 625 404	5 318		
	Long Beach, Calif	1 535 818	6 750		
Fairchild E & A Corp.	Farmingdale, N Y	423 000	1 850	NA	90 000 000
	Hagerstown Md.	903 573	5 000		
Grumman Aircraft Engineering Corp.	Bethpage N Y	1 623 686	8 300	84 000 000	184 000,000[8]
Lockheed AircraftCorp.	Burbank Calif	4 720 317	14 000	115 000 000	230 000 000
Glenn L. Martin Co.	Middle River Md.	2 703 415	7,600	47 500,000	NA
McDonnell Aircraft Corp.	St Louis, Mo.	1 891 311	3 671	32 635 381[9]	81 898 541[7]
North American Aviation Inc.	Los Angeles, Calif.	2 818,734	11 505	129 633 623	229 042 487
	Long Beach, Calif	588,003	1 832		
	Downey Calif	970 863	3 432		
Northrop Aircraft Inc.	Hawthorne, Calif	1 458 555	6,750	30 000 000	65 800 000
Piasecki Helicopter Corp.	Morton Pa.	55,000	700	8 000 300	16 000.000
	Philadelphia Pa	50 000	100		
Republic Aviation Inc	Farmingdale N Y	1 600 000	6,700	40 000 000	53,800 000[10]
Ryan Aeronautical Co.	San Diego, Calif	940 597	1 300	15 000,000	7 000 000
United Aircraft Corp	East Hartford Conn. (Pratt & Whitney)	3 847 000	18 000	222 000 000	368 000.000[11]
	East Hartford Conn. (Hamilton Std. div)	500 000	2 800		
	Dallas Texas (Chance Vought div)	1 800 000	8 300		
	Bridgeport Conn. (Sikorsky div)	325,730	1 200		
TOTALS —		56 406 752	197 607	$1 132 126 560	$2 413 778 847

*Prime engine and airframe contractors for the services with exception of General Electric Co and Westinghouse Electric Corp which did not furnish data before closing data

[1]AVIATION WEEK estimate

[2]Estimated as of Dec 31 1949 except where shown

[3]Fiscal year ending Sept 30, 1949

[4]Nine months to Sept 30 1949

[5]Nov 30 1949

[6]Oct 1 1949

[7]Estimated for fiscal year ending Nov 30 1949

[8]Oct 30 1949

[9]Fiscal year ending June 30, 1949

[10]Dec 31 1950

[11]Sept 30, 1949

Source: Manufacturers reports and AVIATION WEEK estimates.

present industry state with the minimum levels set by the President's Air Policy Commission for peacetime procurement to maintain an adequate level on which to build wartime expansion shows the 1950 level of 30 to 35 million lb is within the 30-40 million lb level proposed by the Commission.

As to meeting the 70 group Air Force schedule also called for by the Commission, however, the present procurement schedule is far from adequate due to the Truman Administration and Secretary Louis Johnson impounding funds which Congress had appropriated to strengthen the Air Force beyond the 48 groups allowed by the administration.

▶ **Less Than 1100**—Best schedules available (as this is written) for 1950 procurement call for less than 1100 airplanes for both USAF and Navy as opposed to the peak of over 5000 a year required for the original 70 group program.

Indications are that if USAF is held to the limited procurement schedule now set, only 32 groups out of the 48 group Air Force now set as the minimum will be equipped with modern postwar combat craft, while the remaining 16 groups will be using old World War II planes, taken out of storage.

▶ **Manufacturing Methods**—Industrial planning and studies of modernizing manufacturing methods in order to produce more efficiently the stronger aircraft structures and more powerful engines needed for the high speeds into which modern warfare has moved since World War II, are expected to play even a more important role in 1950 aircraft production than they did in the year just closed.

Notable example of such production engineering is the recent opening by USAF of a manufacturing methods pilot plant at Adrian, Mich., where huge forging presses and extrusion presses are being installed for experimentation and study on new forging techniques and procedures.

▶ **40 Projects**—Engineering representatives of principal USAF contractors met at Dayton this month to discuss 58 projects for improving manufacturing techniques and to select 40 of these to be undertaken with USAF funds. Some fields suggested for investigation in such projects include:

- Precision castings to produce whole aircraft and missiles.
- Development of automatic stack routing and drilling equipment.
- Hot forming of non ferrous metals.
- Further development of the forming by stretching process.
- Automatic welding of aluminum and of magnesium.

Important impact on the entire U. S.

aircraft industry is expected to be felt in 1950 from the produceability specifications which the USAF now is finalizing Objective of these specifications is to insure to the greatest possible degree that military aircraft designs selected for development shall be capable of quick adaptation into high volume production in the event this is required

▶ **Produceability Data**—Discussions have been held over the question of selecting the stages at which various produceability data for a design shall be required Industry has recommended that manufacturers not be required to submit produceability data with their preliminary design bid proposals, and that detailed design produceability data be required only after contracts have been given for advanced design studies or prototype aircraft It has been further recommended that manufacturing produceability studies and data shall be supplied only in competitions for production contracts

Factors entering into produceability evaluation include such things as use of critical and of nonstrategic materials interchangeability of structural items breakdown of equipment installations; description of unconventional manufacturing techniques and processes breakdown of structure and major components construction including major service joints and major structural members, etc.

▶ **Subcontracting**—Effect upon the industry of subcontracting is expected to be more far-reaching in 1950 than in 1949 Contracting for the Boeing B-47 six jet bomber and for the General Electric J-47 turbojet engine, used in the same airplane were notable experiments in 1949 with subcontracting parts and sub assemblies on this plane and engine to hundreds of smaller manufacturers

Meanwhile other industrial planning programs are being developed with various manufacturers to permit licensing other manufacturers to produce a complete article, such as an engine, or airplanes, and to get into production promptly on this article

▶ **Standardized Requirements** — Still greater unification among the military services buying from the aircraft industry is likely to be reflected also even more in 1950 than previously, on aircraft production Purchases of such items as trainers, engines, propellers and virtually every item that is not peculiarly adapted to one service's special needs, will follow the trend toward standardization

Production of guided missiles, or pilotless aircraft, while subordinated in volume to piloted plane production is being projected at increasingly larger rates in the early future

Engine Industry Still in Transition

Piston powerplants have wide utility, but turbojet and turboprop looming larger in production picture.

Five years after the heavy impact of the jet revolution in aircraft propulsion, the U S engine industry is still in a state of transition with no very clear course looming for the future.

Contrary to some of the enthusiastic postwar predictions of five years ago, the turbojet has not yet become the universal aircraft power plant. About half of U S engine production during 1949 was still devoted to piston engines. Turbojets accounted for the remainder of production with the turboprop just beginning to emerge at year's end as a production item. Rocket and ramjet engines are still in early experimental phases.

▶**Wide Choice**—The most significant fact in the present aircraft power picture is that the airplane designer is now confronted with a variety of basic power plants each of which are peculiarly suited for particular jobs. No jack of all-trades has emerged from the post-war power picture to match the prewar stature of the piston engine.

This has created a new and expensive problem for management of engine companies. They must now have two or more design staffs if they are in development work on more than one engine type.

Where speed is the primary requirement, the turbojet rules supreme. Where range and altitude are essential, the piston engine continues unchallenged. For medium altitude operations where a compromise between speed and range is necessary, the turboprop is edging strongly into the picture. Where the rocket and ramjet will find their forte is not yet clear.

▶**Compromises**—Indicative of the power compromises that now face the aircraft designer is the generation of composite-powered aircraft in Naval Aviation where piston engines are used to get long range cruise, and combined with turbojets for relatively short bursts of high speed.

Examples of these hybrids are the Martin P4M using two Pratt & Whitney Wasp Majors and two Allison J 33 turbojets and the North American AJ 1 using two P & W R-2800 piston engines and a single Allison J-33.

▶**Turboprop**—One of the most significant events of last year in the American engine field was the entrance of the turboprop into the powerplant potpourri. Turboprop development in the U S. has been kept alive by the Navy which saw in it a solution to the operation of long range patrol planes and carrier based bombers of increased size. U.S. Air Force has blown hot and cold on the turboprop.

Less than 18 months ago USAF proposed to hang turboprops on all

(Continued on page 53)

U. S. Propeller Manufacturers

Manufacturer	Classification	Pitch Actuation	Hp. Range	Blade Data: Price Range	Blade Data: Number	Blade Data: Diameter (in.)	Construct	Military Planes Using
Aeromatic Propeller Dept Koppers Co. Inc. Bellmore Md	CA, CP, CR AV	Hyd, Mech[1]	50-500	$400	2-4	72 108	Wd[2]	OY 1
Aeroproducts Division General Motors Corp Dayton Ohio	CP, CS, RP, PP, CR, AV	Hyd	500-3000+	$5000-$25,000+	2-8	99 216	St[3]	C 45, T-28, P 82, F8F, AD-2, A-4M, XP5Y
Beech Aircraft Corp Wichita Kan	CS, FF	Elec	240-300	[illegible]	2	88-98[4]	Wd,[5] AL	Beech T-34
Curtiss Wright Corp Propeller Division Caldwell N J	CP, CS, RF, FF, CR, AV, SR, SFP	Elec, Elec-Mech	1000-3000+	[illegible]	3-8	120-252	St[6]	AM-1, R-29, R-36, R-50, C-74, C-97, C-99, C-118, C-121, C-122, JRM-1, 2, P8M-5, SA-2, R-12, R60-1, C-124, C-125, ZPG Airship L-13
Flottorp Mfg Co Grand Rapids Mich	FF, GA, CP	Hyd, Mech	50-200	$50-$400	2	63-102	Wd[7]	
G. R. Lewis Co. Watertown Wisc	FP	[illegible]	50-200	$50-$100	2	68-76	Wd[8]	None
Hamilton Standard Propeller Division United Aircraft Corp E. Hartford Conn	TP, CP, CS, RP, FF	Hyd	200-3000+	[illegible]	2-4	96-198	AL,[9] St[10]	R4Q, AM-1, AJ, P4M, F2V,, AF-2W, AF-2S, F4U-5, C-119, C-97, XC-120, C-82, XC-123, C-125, T-31, T-29, SA-16, YC-124A
Hartzell Propeller Co. Piqua Ohio	GA, TP, CP, CS, RF, CR	Hyd	50-500	$50-$400	2-3	68-102	AL, Fl[11]	L-5, L-17, UF
McCauley Corp Dayton Ohio	FP	[illegible]	50-200	$125-$200	2	58-90	AL[12]	L-16A, L-16B, YL-15
Sensenich Corp Lancaster, Pa	FP, GA, TP, CP, CS	Hyd	50-200	$50-$400	2-4	60-102	Wd,[13] Mo	
U S Propellers, Inc Pasadena, Calif	FF, GA, CP, AV[14]	Mech[14]	50-1000	$50-$400	2-9	70-150	Wd[15] AL[16]	

AL-aluminum alloy
Av-automatically variable
Cp-controllable pitch
AL aluminum alloy
AV-automatically variable
CP-controllable pitch
CR-counter-rotating
CS-constant speed
Elec-electric
Elec-Mech-electric mechanical
FF full feathering
FP fixed pitch
GA-ground adjustable
Hyd-hydraulic
Mo metal
Mech mechanical
RP-reversible pitch
SFP selective fixed pitch
SR single rotating
St steel
TP-two position
Wa-wood

1-Models F200H and 220H are hydraulically actuated, model 220-1 is mechanically actuated
2-Laminated maple or birch with plastic covering and metal tipping.
3-Hollow steel incorporating reinforcing rib.
4-91 in. model is constant speed experimental type
5-Wood plastic covered flush tipping
6-Two machined preformed sheets welded together to form hollow monocoque
7-Laminated birch plastic covered
8-Laminated birch
9-Solid aluminum alloy ground from forging
10-Airfoil envelope with control spar for core and spaces are filled with vulcanized sponge rubber
11-Solid plastic construction Herlatite compound on with stainless steel tipping
12-Drop forged heat treated
13-Controllable models are made from laminated wood blank plastic covered, metal tipping
14-Made to specifications only
15-Laminated birch
16-Aluminum and plastic, plastic covered

U.S. Gas Turbine Engines

Manufacturer	Model	Type	Compressor stages	Turbine stages	Compression ratio	Static thrust, lb	At rpm. at sea level	Rated thrust at SL	At rpm	Shaft hp.	At srpm. at sea level	Spec. fuel cons. lb./hr./lb thrust or shp.	Turbine inlet F. deg.	Tailpipe, F. deg.	Overall length, in	Overall diameter, in.	Dry weight, lb.	Gross weight, lb
Allison Division General Motors Corp. Indianapolis, Ind.	400 (J-33 A-23)[1]	C	1	1	4.4:1	5400[2]	11,750	3900	11,250	....	....	1.12[3]	....	1290	107[4]	50.5	....	1795
	450 (J-35-A-17)[5]	A	11	1	5:1	5000	7800	4240	7400	....	....	1.05[3]		1185	146	37		2360
	500 (XT40)[6]	TP	17	4	6.3:1	....	....	....	....	5500	....	.63		....	84[7]	25x39	....	2500[8]
	501 (XT38)	TP	17	4	6.3:1	....	....	....	....	2750	....	.63		....	84[7]	20	....	1225[8]
American Helicopter Co., Inc. Manhattan Beach, Calif	AJ # 75	PJ	....	....	....	95	....	....	....	....	....	2.5	....	....	48	8.75	20	....
Boeing Airplane Co. Seattle, Wash	500	C	1	1	3:1	190[9]	36,000	165[10]	36,000			1.22	1500	1250	29[11]	22		111
	502	TP	1	2	3:1	....	....		....	200[12]	2700	1.2	1500	1150	42	22	....	184
Frederic Flader, Inc N. Tonawanda, N. Y	124 (J 55-FF-1)	A	....	1	....	770	28,200	700	26,800			1.64	....	1170	79	15.75	....	300
General Electric Co. Aircraft Gas Turbine Div. West Lynn, Mass.	TG-190 (J-47)	A	12	1	....	5200[13]	....	....	....	....	....	....	....	....	144	36.75		2500*
Pratt & Whitney Aircraft Div United Aircraft Corp. East Hartford, Conn	JT 6B (J-42)[15]	C	1	1	....	5000[14]	....	4000	....	....	....	109	....	....	103.2[17]	49.5	....	1723
	JT 7 (J-48)[15]	C	1	1	....	6250[16]	....	....	....	....	....	....	....	....	103.2[17]	50	....	2000*
Westinghouse Electric Corp. Aviation Gas Turbine Div. Philadelphia, Pa.	24C4B (J 34 WE-22)	A	11	2	....	3000	....	2290	....	....	....	....	....	....	120	24	....	1200

* - approximate
A - axial flow
C - centrifugal flow
PJ - pulsejet
srpm - shaft rpm
TP - turboprop

1 - Present allowable time between overhauls for this engine is 300 hr. Navy designation is J-33-A-10, engine is similar except for accessory housing. A later model has afterburner.
2 - Using water/alcohol injection.
3 - At cruising.
4 - With tail cone.
5 - Present allowable time between overhauls is 300 hr.
6 - Two T-38 power sections joined to form one unit connected to reduction gear by extension shafts. Each unit can operate the 6-bladed Aeroproducts contra-rotating props independently or together.
7 - Plus extension shafts and reduction gear.
8 - Includes shafting and reduction gear.
9 - Takeoff static rating.
10 - Continuous static rating.
11 - Without tail cone.
12 - Takeoff static rating. Continuous static rating is 160 shp. at 2450 srpm.
13 - Without augmentation; more with water injection.
14 - Thrust rating wet is 5750 lb.
14 - Thrust rating wet is 5750 lb.
15 Powers Grumman F9F-5, Lockheed F-94B and North American F-93A.
16 Approximately 8000 lb. thrust with afterburner.
17 Without afterburner.

its new bombers including the Boeing B 52 and B 55 Then it became convinced that turbojet progress would be so rapid as to make an interim phase of turboprops unnecessary Now with the anticipated range and power developments in turbojets still a long way around the corner, USAF has swung back to turboprops and probably will draw heavily on the Navy-financed projects for its heavy bombers and transports

The Allison T-38 of 2750 eshp and the double T-40 unit of 5500 eshp made the initial dent in what had been complete British superiority in this field. The T-38 axial-flow was the first Allison contribution to gas turbine design, all other Allison-produced jet engines having been designed elsewhere

Of the original turboprop field that once included General Electric, Westinghouse, Chrysler, de Laval and Curtiss-Wright, only Pratt & Whitney and Northrop, in addition to Allison, are still active contenders A turboprop of Pratt & Whitney's own design has been running on a test stand for more than a year The Northrop pusher Turbodyne (XT 37) was being readied for installation in a Flying Wing test bed when USAF shut it off

▶ **Propellers**—One corollary of the turboprop development has been the new vista opened for propellers Research by NACA, Aeroproducts, Hamilton Standard and Curtiss has indicated that a supersonic propellor is feasible and that the turboprop engine can utilize its potential powers to drive combat aircraft at speeds in excess of Mach 1

This indicates a brighter future for both turboprop engine and propeller in combat planes as well as fast-burgeoning commercial prospects Allison is already making a test installation of the T-38 in the Convair-Liner transport and most airframe manufacturers with transport designs now flying are studying application of the turboprop to their existing airframes

▶ **Turbojets**—The year saw two significant developments in turbojets First, the surprising renaissance of the centrifugal-flow jet as exemplified in the Pratt & Whitney J-48 and Allison J-33 With official ratings of 6250 lb static thrust for the J-48 and 5400 lb for the J-33, they were the most powerful jets now flying in this country Further development of the centrifugal flow type now promises to attain power ratings that were once thought practical only through use of axial-flow designs

Second, axial-flow development also registered remarkable, though unpublicized, gains during the year Progress of axial-flow designs now makes it safe to predict that they will bring the jet engine to the 10,000 lb static thrust

U. S. Aircraft Production

1949

AIRCRAFT

Month	PERSONAL Number	PERSONAL Weight	PERSONAL Value	TRANSPORT Number	TRANSPORT Weight	TRANSPORT Value	MILITARY[1] Weight	MILITARY[1] Sales	Total Airframe Weight	Total Sales[2]
January	161	136 100	$936 784	6	144 500	$2 630 099	2 000 600		2 281 100	
February	226	186 200	1 185 768	31	891 500	10 285 545	2 677 900	$167 000 000	3 351 500	$229 226 398
March	376	289 600	1 856 418	23	427 100	3 587 990	3 220 900		3 937 600	
April	486	324 000	2 058 853	16	230 500	6 248 500	1 784 600		2 380 200	
May	461	304 700	1 897 748	13	147 000	3 282 768	985 000	232 000 000	1 436 700	264 000 000
June	430	283 000	1 848 173	6	269 000	6 547 466	2 460 700		2 998 800	
July	[4]301	[4]478 400	[4]1 500 000	([4])	([4])	[4]7 006 772	2 817 200		3 298 000	
August	[4]272	[4]506 000	[4]1 200 000	([4])	([4])	[4]8 576 543	3 410 300	243 000 000	3 919 500	289 480 761
September	271	191 000	1 216 578	13	455 000	12 783 932	2 308 100		2 884 100	
October	216	100 300	1 114 544	12	486 930	13 305 401	1 697 800		2 414 400	
November	143	113 700	746 137	10	413 600	10 729 111	2 828 900	NA	3 355 500	NA
December	106	85 000	639 650	10	409 200	13 762 143	3 649 700		4 229 500	
	3 409	3 057 700	$16 900 021	151	3 701 700	$104 827 077	29 737 100	$063 000 000	36,430 900	$770 679 176

ENGINES

Month	CIVIL Number	CIVIL Horsepower	CIVIL Value	MILITARY[1] Horsepower	MILITARY[1] Sales	Total Engine Horsepower	Total Sales[3]
January	265	112 400	$1 331 488	2 318 100		2 438 500	
February	403	142 300	1 478 662	2.772 900	$161 000 000	2 915 200	$113 400 000
March	604	123 400	1 163 578	3 604 000		3 729 400	
April	602	119 600	1 120 697	3 474 000		3 593 600	
May	479	121 300	1 304 979	3 777 400	108 000 000	3 898 600	120 000 000
June	364	98 300	1 110 431	3 444 900		3 542 300	
July	286	86 100	1 080 260	4 316 700		4 404 800	
August	283	62 300	739 855	3 671 800	116 000 000	3 733 800	127 400 000
September	200	87 100	1 170 247	4 634 200		4 721 300	
October	174	78 400	1 050 735	5 070 900		5 149 300	
November	192	82 080	963 708	4 622 900	NA	4 404 000	NA
December	163	123 400	4 548,000	4 044 900		4 168 000	
	3 987	1 234 300	$17 122 570	45 164 800	$425 000 000	46,365 100	$360 000 006

[1] Unit shipments for military aircraft and engines restricted.
[2] Includes complete aircraft and parts for military and civil shipments for quarter
[3] Includes engines and parts for military and civil shipments for quarter
[4] July and August shipments not separated by personal and transport type to avoid disclosing shipments of individual companies Because number of transport planes shipped in those months was small, total unit shipments and total airframe weight in those two categories for the two months have been listed under personal Value for personal and transport planes shipped in the two months is an Aviation Week estimate

Total sales for the first nine months of 1949 were $1,270,000,000 including, in addition to aircraft and engines, propellers and parts ($47,000,000) and other products and services ($84,000,000).

Source Bureau of Census Forms M42A and M42D

goal in less than a decade after the first operational use of turbojets in this country.

The field of really large axial flow jets is now the hottest competitive segment of the engine business. Westinghouse and Pratt & Whitney, with its own axial-flow design, are currently leading the pack. But Allison, General Electric and Wright are still very much in the race.

► **Piston Engines**—Piston engine development still continues. Both Wright Aeronautical and Pratt & Whitney have developed compounded versions of their most powerful piston engines that offer an economy of operation that cannot be ignored in airline economics or the military demands for range.

The Wright compound version of the R-3350 is scheduled for use in the Lockheed P2V Navy patrol bomber and the Douglas AD-2 series of Navy attack bombers. The P&W compound version of the R-4360 is in an advanced development stage with installation scheduled for late models of the B-36.

► **Methods**—Engine manufacturing methods have shifted away from the heavy metal-cutting processes typical in piston-engine production to the preponderance of sheet metal working involved in making jets. In the early phases of jet manufacturing, the man-hours required are about equal to piston-engine production. However, as a manufacturer acquires more skill on the jet process, the manhours shrink.

Cost of production per horsepower is about the same for both types of engines. Interchange of production workers is also feasible between piston and jet operations although a much higher percentage of sheet metal workers are required for the latter. Jets are easier to assemble than piston engines, with most of the difficulties encountered in the precise manufacturing of detailed parts such as turbine blades.

► **Outlook**—Outlook for future engine business indicates that the volume of business in prospect for the next five years will not be sufficient to support profitable operations for the five major firms now in the field. Intensification of competition for the business available is a symptom.

Of the five major manufacturers, only Pratt & Whitney has active projects in all three basic types of aircraft power—piston, turbojet and turboprop. Allison, now the largest producer of turbojets, is also entering production of turboprops. Wright's main production continues in piston engines and their compounded versions, with continued experimentation in turboprops and rockets. Westinghouse and General Electric are concentrating both production and research primarily on the turbojet.

Monthly Aircraft Employment*

(In Thousands)

	Aircraft	Engines and Parts	Propellers and Parts	Other Parts and Equipment	Total
December, 1948	168 3	50 4	7 7	25 8	252 2
January 1949	168 5	52 1	7 6	26 7	254 9
February	168 9	52 2	7 6	27 3	256 0
March	171 0	52 8	7 7	27 9	259 4
April	171 0	53 0	7 7	27 6	259 3
May	169 8	53 8	7 8	22 7	254 1
June	169 3	53 1	8 1	23 2	253 7
July	172 8	52 3	8 2	26 3	259 6
August	171 7	46 2	8 0	26 3	252 2
September	171 2	52 4	8 2	26 5	258 3
October	168 8	52 1	8 2	26 3	255 4
November	163 1	51 3	8 1	26 3	248 8
1947 Average	151 4	47 8	7 4	22 8	228 6
1948 Average	151 7	46 7	7 4	22 4	228 1

* Source: Bureau of Labor Statistics. Figures cover all full-time and part-time employes.

More Aircraft Jobs in 1949

July showed year's peak with 259,000. Employment highest in "aircraft" class of four special categories.

Employment in aircraft and parts plants slumped toward the end of 1949, but wound up the year still about 10 percent higher than the average for 1948 and 1947.

Jobs followed their usual pattern, with rising employment during the first part of the year and a decline in the second half. The year started with 254,900 employes in January, hit a peak of 259,600 in July, then dropped to 248,800 in November, according to the Bureau of Labor Statistics December figures, when they came in were expected to show no change from November.

For the first time, BLS has divided aircraft employment into four special categories.

• **Aircraft**. This group is composed of 58 plants making complete aircraft, such as airplanes, gliders, dirigibles and balloons, and may also manufacture aircraft parts and auxiliary equipment. They were the largest group, providing 163,100 jobs in November.

• **Aircraft Engines and Parts**. There are 57 companies in this group, employing the second largest number of workers—51,300 in November. Important products are internal-combustion and jet propulsion engines, engine mount parts, air scoops, turbo-superchargers, lubricating, cooling and exhaust systems, non-electric starters and aircraft engine pumps.

• **Propellers and parts**. Thirteen companies in this group, employing 8100 in November, make variable and fixed propellers and propeller parts such as accumulators, blades, feathering pumps and governors.

• **Other parts and equipment**. These companies, numbering over 200, employed 26,300 in November. They make aircraft parts and auxiliary equipment not classified elsewhere. Aeronautical instruments and aeronautical electrical equipment are not included, either.

Last year BLS did two things to improve the aircraft employment statistics along with its other series.

It abandoned the old industry classifications of the Social Security Board and shifted to the Standard Industrial Classification Code used by the Bureau of the Budget. And it adopted a new "bench mark" based on actual 1947 employment.

Previously, BLS reported aircraft employment in only two groups—aircraft and parts (excluding engines) and aircraft engines.

BLS checked all employers in 1947 as to their products. This enabled BLS to weed out of the aircraft statistics those companies which had switched to other products after the war. It also added other companies that had entered the industry. Thus, the statistics were made more accurate. Spot testing in 1948 showed no significant shifts in or out of the aircraft field.

Month-to-month changes in employment are determined by sampling.

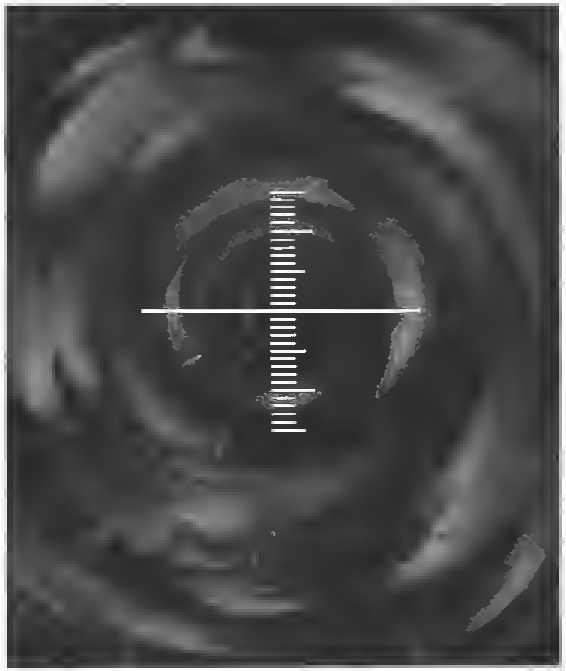
U.S. Reciprocating Engines

Manufacturer	Model	Cooling System	Number of Cylinders	Cylinder Arrangement	Propeller Drive	Rating: Rated Hp.	Rating: At R.P.M.	Rating: At Altitude (ft.)	Rating: Octane Fuel	Weights: Total dry without hub or starter	Weights: Lb per hp	Bore and stroke (in.)	Displacement (cu in.)	Compression Ratio	B.M.E.P.	Blower	Dimensions: Diam. Mount Ring or distance between bearers (in.)	Dimensions: Ht. or O.D. (in.)	Dimensions: Length without starter (in.)	Guaranteed Fuel Consumption at Cruising Hp (Lb. per hp per hr.)	Maximum Oil Consumption at rated speed	Cylinder Construction	Make spark plugs supplied with engine	Make Ignition	Make of Carburetors	Make of Starter
Aircooled Motors,	4A4-90-B3	A	4	ho	D	90	2300	SL	80	230[1]	2.56	4.5x3.5	225	7	138		31.21	27.59	30.68[4]	.50	.015	al	Ch	Ei	MS	Au
Inc.	4A4-100-B3	A	4	ho	D	100	2550	SL	80	230	2.30	4.5x3.5	225	7	138		31.21	27.59	30.68	.50	.015	al	Ch	Ei	MS	Au
Syracuse 8, N. Y.	6A4-150-B3	A	6	ho	D	150	2600	SL	80	321[1]	2.14	4.5x3.5	335	7	136		31.21	22.59	37.37[4]	.50	.015	al	Ch	Ei	MS	DR
	6A4-165-B3	A	6	ho	D	165	2800	SL	80	324[1]	1.97	4.5x3.5	335	7	140		31.21	25.21	37.37[4]	.50	.015	al	Ch	Sc	MS	DR
	6V4-178-B32[2]	A	6	vo	D	178	3000	SL	80	308[1]	1.73	4.5x3.5	335	7	140		30.81	38.18	30.75	.52	.015	al	Ch	Sc	Be, MS	DR
	6V4-165-B32F[2]	A[3]	6	vo	D	165	3000	SL	80	356[1]	2.16	4.5x3.5	335	7	138		30.81	42.50	30	.55	.015	al	Ch	Sc	Be MS	DR
	6V4-200-C32[2]	A	6	vo	D	200	3100	SL	91	333	1.66	4.5x3.5	335	8.5	152		31.12	38.18	29.03	.52	.015	al	Au	Sc	Be MS	DR
	6AG4-185-B12	A	6	ho	G .632:1	185	3100	SL	80	369	1.80	4.5x3.5	335	7.5	145		31.15	26.12	40.59[4]	.51	.015	al	Ch	Sc	Be MS	DR
	6V6-245-B16F[2]	A[3]	6	vo	D	245	3275	SL	80	353	1.44	4.7x4	425	7.5	140		33.28	38	37.21	.52	.015	al	AC	Ei	Be	
	6A8-215-B8F	A[3]	6	ho	D	215	2500	SL	80	467	2.26	5x4.2	500	7	136		33.90	29.25	46	.55	.015	al	Au	Ei, Sc	MS	Au
Continental Motors	A65-8	A	4	ho	D	65	2300		73	176	2.7	3.8x3.6	171	6.3					31[5]	.49	.010		Au	Ei JIC	Str	
Corp.	C75-12	A	4	ho	D	75	2275		73	184	2.42	4x3.6	188	6.3					32[5]	.52	.010		Au	Sc	Str	DR
Muskegon 82, Mich	C85-8F	A	4	ho	D	85	2575		73	176	2.07	4x3.6	188	6.3					31[5]	.51	.010		Au	Sc	Str	
	C85-12	A	4	ho	D	85	2575		73	184	2.14	4x3.6	188	6.3					32[5]	.51	.010		Au	Sc	Str	DR
	C90-8F	A	4	ho	D	90	2475		80	184	2.07	4x3.8	201	7					31[5]	.52	.010		Au	Sc	Str	DR
	C90-12F	A	4	ho	D	90	2475		80/87	188	2.06	4x3.8	201	7					32[5]	.52	.010		Au	Sc	Str	DR
	C125-2	A	6	ho	D	125	2550		73	256.8	2.05	4x3.6	282	6.3					41[5]	.50	.017		Ch	Sc	MS	DR
	C145-2	A	6	ho	D	145	2700		80/87	265	1.82	4x3.8	301	7					41[5]	.50	.017		Ch	Sc	MS	DR
	E165	A	6	ho	D	165	2050		80/87	344	2.08	5x4	471	7					46.66[5]	.51	.017		BG	Sc	Str	DR
	E185	A	6	ho	D	185	2000		80/87	344	1.84	5x4	471	7					46.66[5]	.50	.020		BG	Sc	Str	DR
	GE240-1	A	6	ho	G .69:1	240	2100		80/87	394	1.60	5x4	471	7					52.03[5]	.53	.020		BG	Sc	Str	Ec
	W670-2	A	7	rad	D	240	2200		80/87	519	2.12	5.1x4.6	467.8	6					35.56[5]	.52	.025		Ch	Sc	Str	
	R-9A	A	9	rad	D	500	2300		91	705	1.34	5x5.5	972	6.3					42.5[5]	.46	.025		Ch	Sc	Str	
Jacobs Aircraft	O-240A	A	4	ho	D	100	2300	SL	80	200	2.04	4.37x4	241	6.5	143		16	18.1	39.6	.50	.015	als	Op	Dr, Ei	MS	Dr
Engine Co.	O-360A	A	6	ho	D	165	2400	SL	80	300	1.82	4.37x4	361	6.5	151		16	18.1	47.4	.50	.015	als	Op	Dr, Ei	MS	Dr
Pottstown, Pa.	R-755A	A	7	rad	D	300	2200	SL	80	505	1.68	5.25x5	757	6	163		16.5	44	39.6	.45	.015	als	Ch	Sc	Str	Ec
	R-755E	A	7	rad	G3:2	350	2500	SL	91	800	1.72	5.25x5	757	6.5	146		16.5	44	42.3	.46	.025	als	Ch	Sc	Str	Ec
	R-915A	A	7	rad	D	375	2300	SL	80	560	1.49	5.5x5.5	914	6	141		16.5	45.6	40.4	.50	.015	als	Ch	Sc	Str	Ec
Lycoming-Spencer	O-145-B2	A	4	ho	D	65	2550	SL	73	163.4	2.54	3.6x3.5	145	6.5	140			20.59	24.62	.51		al	Ch	Sc	MS	
Div. AVCO Mfg.	O-235-C1	A	4	ho	D	108	2600	SL	80	235[6]	2.26	4.3x3.8	233	6.75	141			22.53	29.56[6]	.52		alS	Ch	Sc	MS	DR
Corp.	O-290-D	A	4	ho	D	125	2600	SL	80	258[6]	2.06	4.8x3.8	289	6.5	132			22.81	29.56[6]	.52		alS	Ch	Sc	MS	DR
Williamsport, Pa.	GO-290-A	A	4	ho	G77:120	160	3000	SL	91/98	376[6]	2.35	4.8x3.8	289	7.5	146			28.5	34.59[6]	.49		alS	Ch	Sc	MS	DR
	O-435-A	A	6	ho	D	190	2550	SL	80	392[6]	2.32	4.8x3.8	434	6.5	136			29.59	38.10[6]	.52		alS	Ch	Sc	MS	DR
	O-435-A2	A	6	ho	D	225	3000	SL	91/98	392[6]	1.93	4.8x3.8	434	7.5	137			29.59	38.10[6]	.51		alS	Ch	Sc	MS	DR
	GO-435-A2	A	6	ho	G77:120	240	3000	SL	91/98	460[6]	1.91	4.8x3.8	434	7.3	146			29.59	40.71[6]	.47		alS	Ch	Sc	MS	DR
	GO-435-C2	A	6	ho	G77:120	240	3000	SL	91/98	432	1.80	4.8x3.8	434	7.3	146			29.59	39.57[6]	.47		alS	Ch	Sc	MS	
	GSO-580	A	8	ho	G77:120	320	3000	SL	91/98	619	1.67	4.8x3.8	578	7.3	146	7.91		19.97	57.58[6]	.50		alS	Au	Sc	Be	
	GSO-580-B	A	8	ho	G77:120	350	3000	SL	100/130	624	1.78	4.8x3.8	578	7.3	160	7.91		19.97	57.58	.50		alS	Au	Sc	Be	

Manufacturer	Model	Cooling System	Number of Cylinders	Cylinder Arrangement	Propeller Drive	Rating: Rated Hp.	Rating: At R.P.M.	Rating: At Altitude (ft.)	Rating: Octane Fuel	Weights: Total dry without hub or starter	Weights: Lb. per hp.	Bore and stroke (in.)	Displacement (cu in.)	Compression Ratio	B.M.E.P.	Blower	Dimensions: Diam. Mount Ring or distance between bearers (in.)	Dimensions: Ht. or O.D. (in.)	Dimensions: Length without starter (in.)	Guaranteed Fuel Consumption at Cruising Hp (Lb. per hp per hr.)	Maximum Oil Consumption at rated speed	Cylinder Construction	Make spark plugs supplied with engine	Make Ignition	Make of Carburetors	Make of Starter
McCulloch Motors	4318	A	4	ho	D	Pend	Pend	SL	95	83	Pend	3.18x3.12	99.8	7.8	Pend		8.12	15	27	Pend		al	Ch	Own	Own	Manual
Corp.	4300	A	4	ho	D	60	6000	SL	95	83	1.38	3.x3.12	88.4	7.8	46.3		8.12	15	27	.85		al	Ch	Own	Own	Manual
Los Angeles, Calif.																										
Pratt & Whitney Div.	Wasp Jr. B5[7]	A	9	Rad	D	450	2300	2300	91/98	682[6]	1.54	5.18x5.18	985	6	157	10[13]		46.10	42.43			als	Op	Sc	Be	
United Aircraft Corp.	Wasp S1H1[8]	A	9	Rad	D	550	2200	8000	91/98	865[6]	1.57	5.75x5.75	1344	6	148	12		51.80	43.01			als	Op	Sc	Be	
E. Hartford, Conn.	Wasp S3H1-G[9]	A	9	Rad	G .667:1	550	2200	5000	91/98	865[6]	1.57	5.75x5.75	1344	6	148	12		51.80	47.81			als	Op	Sc	Be	
	Twin Wasp S1C3-G	A	14	RadS	G .5625:1	1050	2550	7500	91/98	1467[6]	1.4	5.5x5.5	1830	6.7	178	7.15		48.19	61.16			als	Op	Sc	Be	
	Twin Wasp D5	A	14	RadS	G 2:1	1200	2550	6400	100/130	1575[6]	1.3	5.75x5.5	2004	6.5	187	7.15		49.10	61.02			als	Op	Sc	Be	
	Twin Wasp 2SD13-G	A	14	RadS	G 2:1	1200	2550	5000	100/130	1595[6]	1.3	5.75x5.5	2004	6.5	187	7.15[13]		49.10	61.02			als	Op	Sc	Be	
	Twin Wasp E1	A	14	RadS	G .4375:1	1300	2800	6000	100/130	1870[6]	1.5	5.75x6	2180	6.7	182	7		54	75.90			als	Op	Sc	Be	
	Double Wasp CA3[10]	A	18	RadS	G .450:1	1800	2600	6000	100/130	2317[6]	1.3	5.75x6	2804	6.75	196	7.15		52.80	78.40			als	Op	Sc	Be	
	Double Wasp CA17[11]	A	18	RadS	G .450:1	1800	2600	6500	115/145	2350[6]	1.3	5.75x6	2804	6.75	196	7.29[13]		52.80	78.40			als	Op	Sc	Be	
	Double Wasp CB1	A	18	RadS	G .450:1	1900	2600	2000	115/145	2357[6]	1.3	5.75x6	2804	6.75	205	7.29		52.80	81.40			als	Op	Sc	Be	
	Double Wasp CB12[12]	A	18	RadS	G .4375:1	1800	2600	8500	100/130	2390[6]	1.3	5.75x6	2804	6.75	176	7.29[13]		52.80	81.40			als	Op	Sc	Be	
	Double Wasp CB16	A	18	RadS		1800	2600	8500	100/130	2390		5.75x6	2804	6.75		8.4			81.40		.025	als	Op	Sc	Be	
	Wasp Major TSB3-G	A	28	RadS	G .357:1	2650	2550	5500	115/145	3482[6]	1.3	5.75x6	4363	7	188	6.375		54	96.75			als	Op	Sc	Be	
	Wasp Major B13	A	28	RadS	G .425:1	2650	2500	6000	115/145	3520[6]	1.3	5.75x6	4363	7	188	6.95[14]		54	101			als	Op	Sc	Be	
Ranger Aircraft Div.	6-440C-2	A	6	id	D	175	2450	SL	65	382	2.18	4.12x5.5	441	6	128		17.875	33.5	53.16	.49		S	BG	Sc	Be	
Fairchild E & A Corp.	6-440C-5	A	6	id	D	200	2450	SL	87	382	1.91	4.12x5.5	441	7.5	146		17.875	33.5	53.16	.44		S	BG	Sc	Be	
Farmingdale, L. I., N. Y.	SGV-770C-1B	A	12	id	G	450	3000	12,000	91	759	1.46	4x5.12	773	6.5	169	9.5	13.375	34.13	66.45	.49		S	AC	Sc	Be	
	SGV-770C-2A	A	12	id	G	800	3150	9000	100	757	1.37	4x5.12	773	6.5	171	8.84	13.375	34.13	66.45	.57		S	BG	Sc	Be	
	SGV-770D-1	A	12	id	G	565	3300	8000	100	855	1.38	4x5.12	773	6.5	181	7.04	13.375	31.11	74.95	.54		S	BG	Sc	Be	
	SGV-770D-4	A	12	id	G	465	3200	13,500	100	896	1.58	4x5.12	773	6.5	173	10.12	13.375	36.75	77.24	.54		S	BG	Sc	Be	
Wright Aeronautical	R-1300-1	A	7	Rad	G16:9	700	2400	5000	91	1045	1.28	6.125x6.3125	1300	6.2	188	7.21[18]		50.45	48.12	.46	.015	Als	Op	Be	Be	Op
Corp.	R-1820-101A	A	9	Rad	G16:9	1275	2500	2000	100	1400	.98	6.125x6.875	1820	6.8	238	7.21[18]		54.95	46.5	.45	.015	Als	Op	Be	Be	Op
Wood-Ridge, N. J.	959C9HE1	A	9	Rad	G16:7	1475	2500	2500	122/145	1390	.91	6.125x6.875	1820	6.8	242	7.21[18]		54.95	48.5	.45	.015	Als	Op	Be	Be	Op
	745C18BA3[15]	A	18	Rad	G16:7	2000	2400	4800	100	2780	1.2	6.125x6.3125	3350	6.5	187	6.46[18]		55.78	76.26	.46	.020	Als	Op	Be	Be	Op
	749C18BD1[15]	A	18	Rad	G16:7	2100	2400	4400	100	2884	1.03	6.125x6.3125	3350	6.5	238	6.46[18]		55.62	78.52	.48	.020	Als	Op	Be	Be	Op
	R-3350-26W[16]	A	18	Rad	G16:7	2300	2600		115/145	2848	1.06	6.125x6.3125	3350	6.5	221	6.46[18]		55.62	81.93	.44	.020	Als	Op	Be	Be	Op
	R-3350-30W[17]	A	18	Rad	G16:7	3250	2900					6.125x6.3125	3350					56.25	91.80			Als	Op	Be	Be	Op

al—aluminum and cast iron
als—aluminum and steel
Au—Autolite
Be—Bendix
Bo—Bosch
BG—BG Corp
Ch—Champion
D—direct drive
Dr—Delco Remy
Ec—Eclipse Ei—Eisemann
G—geared
ho—horizontally opposed
id—inverted
MS—Marvel Schebler
Op—Optional
Rad—radial
RadS—Staggered radial
S—steel
Sc—Scintilla
Str—Stromberg
vo—vertically opposed

1—Weight includes starter, generator, other parts and accessories.
2—For helicopter installation.
3—Cooling fan installed
4—Length includes starter.
5—Length overall
6—Includes starter and other accessories
7—Wasp Jr B4 has same performance but is designed for use with crankshaft in vertical plane
8—Wasp S1H1 G has same performance but has .667 prop reduction gear and dry weight is 953 lb.
9—Wasp S3H1 has same performance but has direct drive and 865 lb. dry weight. S3H2 has same performance, same dry weight, is direct drive, and is designed for operation with crankshaft in vertical plane
10—CA5 has additional 200 hp. at takeoff
11—Similar engines are models CA15, CA18 and CA19
12—CB13 has 1800 normal rated hp. at 2500 rpm. at 7000 ft.
13—Low impeller gear ratios. High ratios are 9.52 for 2SD13-G, 9.10 for CA17
14—High impeller ratio is shown.
15—Direct fuel injection
16—Impeller injection
17—Compound engine
18—Low impeller ratios. High ratios are 8.69 for R-1300-1, 10.14 for R-1820-101A, 8.69 for 959C9HE1, 8.67 for 745C18BA3, 8.67 for 749C18BD1, 8.67 for R-3350-26W



"SIXTH SENSE" for the Automatic Pilot

The new Kollsman Altitude Controller brings positive correction to automatic piloting for the precise maintenance of a selected altitude. Weighing only twenty five ounces, this unit combines the famous Kollsman high precision aneroid diaphragm, the recently developed Kollsman Synchrotel and an especially designed DC magnetic clutch. Sensitivity is such that the Altitude Controller will respond to as little as a two-foot change in altitude and motivate the autopilot accordingly.

Testing now a sister mechanism of the Altitude Controller — the Airspeed Controller which will automatically maintain constant airspeed regardless of meteorological conditions.

Here again is demonstrated Kollsman's unrivalled leadership in aircraft instrumentation and control — especially wherein a pressure-sensitive element is the basic guide. Here is the name to be relied upon for solution of similar or allied problems in practically any industry. Inquiries invited. Address: Kollsman Instrument Division, Square D Company, 80-08 45th Avenue, Elmhurst, New York.

KOLLSMAN AIRCRAFT INSTRUMENTS

PRODUCT OF

SQUARE D COMPANY

ELMHURST, NEW YORK — GLENDALE, CALIFORNIA

Aluminum Production Seen on Upgrade

Aircraft manufacturers can look for an increase in the production of tapered aluminum sheet within the next six months.

The big three in aluminum, Reynolds, Kaiser, and Alcoa, all have been working on the problem of rolling tapered sheet under development contracts issued by the Air Force about a year ago. To date the problems have outridden progress, but progress is being made.

About the best that has been done so far is a 15 to 20 ft. longitudinal (spanwise) taper on a three-ft. width. And, in this experimental work, the tapers have not been completely uniform or perfectly smooth. Trouble mainly has been the controlling of motors which operate speed and pressure on the rolls.

▶ **Progress**—Lately, however, progress has been made on lengthening the taper and smoothing out the operation. Reynolds, for instance, has on order an electronic motor control system which the company believes will eliminate the bumpy sheet and allow longer and wider tapers.

Although the Reynolds experiments have been on small mills, development of the new servo-mechanisms will allow rolling on larger equipment which means widths upwards from 60 inches. In other companys' mills widths may go as high as 120 in. Reynolds work on the material is being conducted at the Lister Hill, Ala., plant.

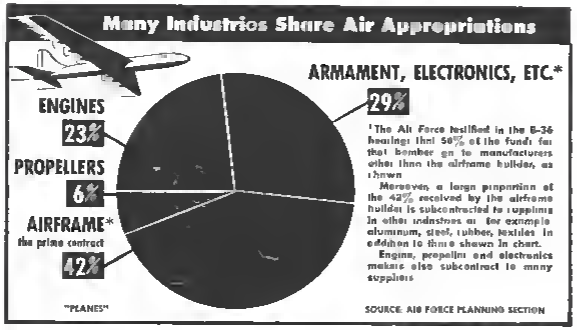
Kaiser's Permanente Metals Corp. has been conducting research on tapered sheet at its Trentwood, Wash., mill. This company is progressing with the problem, although not too much information has been made immediately available.

▶ **Taper Length Problem**—Alcoa's huge new rolling mill at Davenport, Iowa, will allow that company to roll sheet to 120 in. wide. Length of tapers are still a problem. Here again new servo-mechanisms or adaptation of current ones remain a problem. Demand for orders is thought to be holding back rapid advancement on the problem.

In the past year, however, Alcoa has made considerable improvement in the flattening of the rolled product. Samples and some production has been going to a few aircraft manufacturers.

The three companies have found out that it is virtually impossible to roll "sculptured sheet," and vanated tapers, or to roll ribs on the underside of the tapered product.

Various methods of rolling the tapered product have been tried by all three companies with little success outside of the longitudinal roll. Cross wise



rolling (the opposite of longitudinal) failed to work.

Another idea, involving the cutting of an ingot "on the bias," spacing the two wedge-cuts with a divider, then rolling the reassembled ingot, also has not worked out too well. The only realistic method developed so far is a longitudinally (perpendicular to the roll) rolled taper.

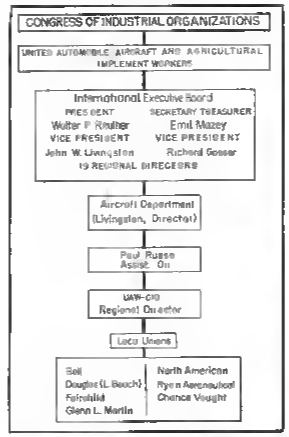
Producers have found, however, that rolling offers one highly important advantage, outside of cost, over milled slabs. Cladding a high-strength alloy core with a protective coat of pure metal can be done with rolling techniques. This cannot be accomplished in machining operations.

Strikes Increase as Production Goes Up

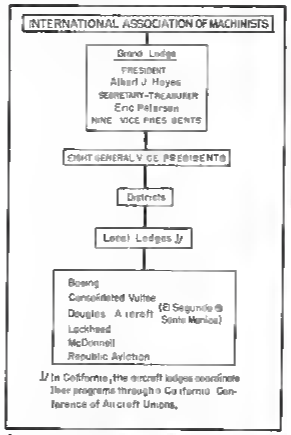
The number of strikes in aircraft and parts turned upward last year after a steady postwar decline. This change in the trend had been anticipated early last year because of the expanding aircraft program.

There were at least ten aircraft and parts strikes last year compared with only eight in 1948. Tentative figures of the Bureau of Labor Statistics for the first half of 1948 list eight strikes, involving 9800 workers, who were idled 289,000 man-days. In the second half, the Bell strike continued through October and two more strikes occurred. One against McDonnell Aircraft lasted almost three weeks. The other, only two

Industry Unions . . .



CIO UAW has unions also at C-W Corp., Wright Aeronautical, Lycoming, Continental Motors, Allison and Aeroproducts divisions of GM



IAM has unions also at Cessna, Beech, Piper, Pratt & Whitney and Hamilton Std. Div. of United Aircraft, Curtiss Propellers

Personal Aircraft Exports*

1949

Country	Units	$ Value	Country	Units	$ Value
Aden Protectorate	1	12,270	Iran	5	24,837
Argentina	12	73,090	Israel	4	7,474
Belgium	6	25,920	Italy	2	13,029
Bermuda	1	3,287	Jamaica	1	4,496
Bolivia	2	8,992	Korea	3	13,539
Brazil	129	658,106	Mexico	26	130,128
Canada	89	318,875	Netherlands W. I.	1	3,181
Chile	22	119,682	Panama	6	13,729
China	10	83,985	Paraguay	4	29,264
Colombia	17	86,617	Peru	1	2,498
Costa Rica	1	1,953	Philippines	2	8,886
Cuba	11	49,388	Portugal	1	3,076
Ecuador	12	40,601	Spain	1	4,496
Egypt	1	9,385	Spanish Morocco	1	1,810
El Salvador	2	7,611	Switzerland	13	73,048
Fiji Islands	1	2,056	Tangier	2	3,839
Fr. Indo-China	2	4,789	Thailand	2	3,737
France	32	94,456	Tunisia	2	3,161
Fr. Morocco	4	8,830	Union of So. Africa	9	46,600
Fr. West Africa	4	7,518	Uruguay	15	101,567
Guatemala	12	35,922	Venezuela	9	43,996
India	6	15,377			
Indonesia	1	2,260	TOTAL	488	$2,207,361

* Four placers and under as made by Aeronca, Beech, Bellanca, Cessna, Ercoupe, Piper, Ryan, Taylorcraft, Texas Engineering.
Luscombe exports included for first six months. None thereafter.
Source: Aircraft Industries Assn.

days, hit Robbins Engineering Co.

When 1949 figures are compiled, they will show about a dozen strikes, involving some 10,000 workers and about 500,000 man-days of idleness.

Other years since the war:

	Number of Strikes	Workers Involved	Man Days Idleness
1944	103	190,000	385,000
1945	85	150,000	581,000
1946	15	21,000	557,000
1947	10	3,500	67,900
1948	8	21,400	1,110,000

Personal Aircraft Shipments

Jan. – Dec. 1949

Manufacturer	Complete Aircraft	Net Billing Price (000)
Aeronca		
Champion 65 hp.	1	
Champion 85 hp.	16	
Chief 65 hp.	1	$ 823
Superchief 85 hp.	22	
Sedan	176	
7CCM [1]	95	
Beech		
Bonanza	298	2770
Bellanca		
Cruisair	27	145
Cessna		
120	9	
140	38	
140A	167	
170	292	4545
170A	177	
190	32	
195	142	
Engineering and Research		
Model E	7	170
Model G	46	
Mooney		
M-18L	73 [2]	131 [2]
Piper		
Cub Special	233	
Supercruiser	1	
Family Cruiser	38	
Vagabond	70	3244
Clipper	713	
Tandem Trainer	20	
Stinson	203	
Ryan		
Navion	215	1816
Taylorcraft		
BC12D-85	33	80
BC12D-65	4	
Texas Engineering		
Swift	52	181
TOTAL	3358 [3]	$14,322 [3]

[1] Military type sold to other than U. S. military customers, [2] 11 months only, [3] includes shipments by Lycoming of 39 9As, 103 8Fs and 15 Sedans, valued at $417,000.

Source: Personal Aircraft Council, Aircraft Industries Assn.

Business Flying Builds Civil Air Power

Use in agriculture and industry offers promise of continued growth.

Increased use of the small airplane in business and industry, including agriculture, continues to promise the most potential for growth of civil aviation in 1950.

Substantial increase in business flying in 1948 over 1947 shows a trend of recognition by additional companies of the utility of the small plane for business travel and special industrial uses. A CAA aircraft use study last year for 1948, on which figures are now available, indicates approximately 40,000 airplanes were used for business, and revenue purposes other than instruction or passenger hauling, or nearly half of the total of 89,550 civil aircraft exclusive of airline planes, in the country.

► **Increase Shown**—Survey showed increase in business plane use, by hours of 31 percent from 1,966,000 in 1947 to 2,576,000 in 1948 and an increase in the number of planes used for business from 26,590 to 32,110. This was in spite of a 7 percent drop in the general use of private and nonscheduled commercial aircraft, from a total of 16,334,000 hr. flown in 1947 to 15,137,000 hr. flown in 1948.

Recently published "plane utility" booklet of Personal Aircraft Council of Aircraft Industries Assn. lists 110 industrial, commercial and agricultural business activities surveyed as plane users, ranging from aluminum boat manufacturers, to water treating equipment and including such dissimilar businesses as dental supplies, real estate, paper manufacturing and cheese processers.

► **Agricultural Use**—A new CAA poll on airplane use in agriculture shows that in nine CAA regions 4908 aircraft (including 63 helicopters) are used for agricultural purposes by 1724 operators. Only 25 of the planes weigh more than 5000 lb. each. Largest group is used as sprayers (1976) while 1064 others are used as dust distributors, 58 as seed distributors, 15 are fertilizer dispensers, and 1793 are combination agricultural planes designed to perform two or more of the functions mentioned.

Latest January, 1950, figures on the number of executive aircraft represented in the Corporation Aircraft Owners Assn., Inc., New York, shows 124 airplanes listed. Of these 88 were twin-engine craft or larger so that only 36 were of the single-engine five-place and smaller, planes. While COAC has grown considerably it still represents only a minute fraction of the total number of business plane users, and it is probable that another organization, Aircraft Owners & Pilots Assn., has more business flyer members in the small plane owner category. (However, COAC as spokesman for business plane owner interests has already made its influence felt with CAA. Result has been better treatment from control towers and fixed base operators for executive planes than had been received heretofore by the single itinerant flyer, without organization backing.)

► **1950 Projection**—Analysis of single-engine plane sales of 1949 and projection into 1950 leads to a conclusion

(Continued on page 51)

Civil Aircraft and Airmen

(As of Jan. 1, each year)

State	1950	1948	1946	Airmen*
Alabama	924	998	391	6,712
Arizona	1,170	1,164	405	6,168
Arkansas	1,192	1,078	481	6 530
California	10,584	10 221	3,732	73 417
Colorado	1 265	1,313	429	8 486
Connecticut	699	755	342	6 913
Delaware	277	247	97	1,394
Dist. of Columbia	533	933	994	2,132
Florida	2,548	2,907	1,190	20,994
Georgia	1,264	1,338	643	9,056
Idaho	873	716	203	4,932
Illinois	4,827	4,503	1,571	30,458
Indiana	2,733	2 718	1 112	15,711
Iowa	2 447	2 190	802	12 229
Kansas	2,795	2,719	962	13,230
Kentucky	821	825	286	5,879
Louisiana	1 066	984	328	6,727
Maine	650	605	206	2,353
Maryland	810	1,184	431	5 275
Massachusetts	1 298	1 454	598	14,674
Michigan	4 245	4,695	1 996	25 905
Minnesota	2 112	2 073	821	12 200
Mississippi	690	720	221	3,919
Missouri	2 140	2,404	1,102	16,035
Montana	1,098	845	288	4,681
Nebraska	1,734	1 534	444	8,131
Nevada	364	422	222	1,524
New Hampshire	288	304	118	2 124
New Jersey	1,682	1 650	694	14 236
New Mexico	744	785	333	3 287
New York	4,472	4 797	2 297	38,520
North Carolina	1,714	1 817	676	8 429
North Dakota	1 235	851	256	2 912
Ohio	4 144	4 789	1,810	27,996
Oklahoma	2,284	2 368	971	14,120
Oregon	1,809	1,619	434	10 072
Pennsylvania	4 063	4,393	2,264	30 835
Rhode Island	198	199	89	2 220
South Carolina	705	836	439	4 590
South Dakota	979	746	207	2 005
Tennessee	1 106	1 206	552	8 174
Texas	6 963	8 347	3,010	39 010
Utah	519	542	206	4 942
Vermont	201	187	79	1 355
Virginia	1 390	1 437	610	6 868
Washington	2,229	2 042	677	17 771
West Virginia	670	690	291	4,115
Wisconsin	2,125	2 012	824	11,405
Wyoming	525	428	140	2,266
Outside Continental U. S.	1 202	947	408	6,553
Total	92 622	94 821	38,378[1]	592,761

[1] Includes 589 gliders not distributed among the states in this tabulation
*As of May 1, 1949
Source: Civil Aeronautics Administration

U. S. Personal and Executive Aircraft

Manufacturer	Designation	Number of Places	POWER PLANT: Number, make and hp of engine	Make of propeller	Diameter, in.	PERFORMANCE: High speed (mph)	Cruising speed (mph)	Landing speed (mph)	Takeoff distance[1] (ft)	Landing distance[2] (ft)	S. L. rate of climb first min. (fpm.)	Normal range (mi)[3]	WEIGHTS: Gross weight (lb.)	Empty weight (lb.)	DIMENSIONS: Span	Length	Height	EQUIPMENT: Instruments (type & make)[4]	Radio	Position lights	Landing lights	Starter	Price, F. A. F.
Aerocar, Inc Longview, Wash	1[5]	2	Airc 4A4100 B3@100	Sen	74	110+	100+	53	1225	400	500+	800+	1750	1252	30	21	7' 2"	1AP, 2USG 3USG, 6AC[6]				DR	$8000*
Aero Design & Engineering Corp. Culver City, Calif.	Aero Commander	5-7	2 Lyc 0-435-A@190	...	82-85	190	180	57	1000	550	1250	1000	4600	2800	43	32	12'	...	GE	Gr	..	DR	30 000*
Aero-Flight Aircraft Corp Long Beach, Calif	Streak 85	2	1 Con C-85@92	Sen	68	175	165	56	812	860	950	750	1400	850	25' 3"	21' 2"	8' 3"	...	H	Gr	GE	DR	...
	Streak 125	2	1 Con C-125@135	Sen	70	202	192	57	702	915	1400	850	1550	955	25' 3"	22' 4"	8' 3"	...	H	Gr	GE	DR	...
Aeronca Aircraft Corp Middletown, Ohio	Champion 7EC[7]	2	1 Con C-90-12F@90	Sen	72	110†	100	44	906	1342	400	351	1450	890	35' 2"	21' 8"	7'	2USG 3USG, 4SW 5SW 6AC, 12SW	Be	Gr	Gr	DR	2695
	Champion 7CCM	2	1 Con C-90-12@90	Sen	.	110	100	42	850	1250	825	...	1400	809	35' 2"	21' 6"	7'	2USG 3USG 4SW, 5SW 6AC	.	Gr		.	2545
	Sedan 15 AC	4	1 Con C-145@145	Sen	...	129	114	53	1000	1600	800	456	2050	1150	37' 6"	25' 3"	7'	2USG, 3USG 4SW 5SW 6AC 12SW		Gr	GE	DR	4848
All American Aircraft, Inc. Long Beach, Calif	Ensign 10 A	2	1 Con C-85@85	McC	74	120	108	55	750	500	700	400	1550	1000	33'	22'	9'	1,2,3P, 4 5 6 7, 11, 12SW	Air	Gr	.	DR	3495
Anderson, Greenwood & Co Houston, Tex.	AG-14[8]	2	1 Con C-90@95	Har	72	120+	118+	...	...	...	700+	400	1400	850	34'	22' 6"	7' 6"	1AP, 2USG 3K 4,5, 6,7 AC	..	Gr		DR	...
Aquaflight, Inc. Wilmington, Del.	Aqua 2	6	2 Lyc 0-435A@190	Aer	78	170	158	55	1050	850	1000	800	4050	2600	36' 6"	29' 6"	12'	2,3 6 9, 10 16, 17 18, 21 all SW	Be	Gr	GE	DR	25 000
Baumann Aircraft Corp. Glendale, Calif.	Brigadier B-290	5	2 Con C-145-2 H@290	Sen	72	175	150	57	1100	400	1360	750	3500	2200	40'	28' 1"	10' 6"	...	Be			DR	22 400
Beech Aircraft Corp. Wichita, Kan.	Bonanza A35	4	1 Con E-185-8@185	Bch	88	184	170	56[9]	1435	850	890	750	2650	1575	32' 10"	25' 2"	6' 6½"	1AP, 2K 8K 6AC 9K 10Sc, 15K 19E 22[10]	..	Gr	GE	DR	10 975
	Bonanza B35	4	1 Con E-185-8@196	Bch	88	184	170	56[9]	...	...	...	750	2650	1575	32' 10"	25' 2"	6' 6½"	1AP, 2K 8K 6AC 9K 10Sc 15K 19E 22[10]	RCA	Gr	GE	Ec	...
	Twin Bonanza 50[11]	5-6	2 Lyc GO-435@260	Bch	.	...	180+	..	...	...	...	1000*	...	...	...	...	...	...	...	...	...	...	...
Bellanca Aircraft Corp New Castle, Del	Cruisemaster 14-19	4	1 Lyc 0-435A@190	Har[12]	78	187	180	43	...	...	1400	680	2600	1525	34' 1"	23'	6' 2"	1AP 2K-P 8K P, 6SW 7SW 9K-P 12SW[13] 10K P	Avi	Gr	GE	DR	9500
	Cruisair 14-13-3 Sr.	4	1 Airc 6A4-150-B3@150	Aer[15]	74	169	150	46	506	437	1100	...	2150	1255	34' 2"	21' 3"	6' 2½"	1AP 2K 6SW, 7SW 9K-P, 8K-P, 10K; 12SW[14], 19E	GE	Gr	GE	DR	...
Cal-Aero Technical Institute Glendale, Calif	XLC-1	1	1 CAX1000[16]@129	None	..	250	200	60[9]	...	...	1380	225	1275	585	20' 10"	17' 11"	5' 11"	...	...		.	..	...
Callair Afton, Wy	Callair A-2 & A-3	2-3	1 Con or Lyc@125	Sen	76	120	108	45[9]	...	...	1000	456	1550	975	35' 9½"	23' 5½"	7'	...		Gr	Gr	Ec	4525
Cessna Aircraft Co Wichita, Kan.	140	2	1 Con C-85 or 90@90hp	Sen	74	125+[17]	105+[18]	41[9]	1645[19]	1530	640[20]	450	1500	900	33' 4"	21' 6"	6' 3¾"	...	...	.	.	..	...
	170	4	1 Con C-145@145	Sen	73	140+	120+	55[9]	1820	1755	690	450	2200	1200	36'	25'	6' 7½"	...	...	.	.	.	...
	190	4-5	1 Con W-670-23@240	Ham	93	170	180	62.5[9]	1670	1495	1050	700+	3350	2050	36' 2"	27' 4"	7' 2"	...	...	.			...
	195	4-5	1 Jac R755-A2@300	Ham	93	180	165	62.5[9]	1500	1495	1200	700+	3350	2060	36' 2"	27' 4"	7' 2"	...	...	.			...
Colonial Aircraft Corp Huntington Sta L. I., N. Y.	Skimmer C-1	2-3	1 Lyc 0-290D@130	Aer	73	125	115	50	...	...	700	700	1950	1300	34'	23' 6"	8' 10"	1,2,4,5 6,7,8,9,10, 14, 19, 23	Na	Gr		DR	9750
Continental, Inc. Danbury, Conn	Airphibian	2[21]	1	Sen	...	120	110	48	...	...	600	...	...	...	...	...	...	1,2,3,4,5,6,7,10,12, 19	..	..	..	.	...
Emigh Trojan Aircraft Douglas, Ariz.	Trojan A-2[22]	2	1 Con C 90-12F@90	McC	..	125	115	48	1460	1460	600	400	1450	874	31' 10"	20' 5"	6' 5"	1,2,3K, 4,5,6,11, 12SW, 24	.		..	DR	3295
Funk Aircraft Co Coffeyville, Kan	B85C[23]	2	1 Con C-85 or C-90@85	Lew	72	115	105	40	400	400	800	400	1350	890	35'	20' 1"	6' 1"	1AP 2,3K 4SW, 6, 7AC, 4SW	...	Gr	..	DR	3895
Jamieson Aircraft Co., Inc. DeLand, Fla	Jupiter J-2-L1	3	1 Lyc 0-235-C1@115	...	74	167	150	40	400	400	1050	700	1800	800	29	20' 10"	6' 9"	1K 2,3 4,5,6,7,11,12, 22SW	..			DR	2500
Johnson Aircraft Corp Tyler, Tex.	Bullet 185	4	1 Con E-185-1@205	Har	78	190	175	58[9]	1250		800	800	2300	1400	28'	23' 1"	8' 3"	1,2 3 4 5 6 7,10,11 12 15,16 19 25	Be	Gr	GE	DR	4995
Mooney Aircraft Inc Wichita, Kan	M-18L[25]	1	1 Lyc 0-145-B2@65	Sen[24]	60	138	115	43	1000	1200	1090	390	780	500	26' 8'	17' 6'	6' 2'	1K, 2, 3USG, 4 5,6SW	..				2250
Morrisey Aircraft Co Long Beach, Calif	Nifty 1000C	2	1 Con C-90-12F@95	Sen	72	122	110	40	290	310	850	325	1550	830	29'	20'	7' 2"	...	..	..			2900*
Piper Aircraft Corp Lock Haven, Pa.	Super Cub 95 (PA 18)[26]	2	1 Con C 90@90		74	112	100	42[27]	1151		700	360	1500	790	35' 3'	22' 4	6' 7'	...		..			...
	Super Cub 105 (PA 18)[26]	2	1 Lyc 108@108		74	117	105	36[27]	960		850	360	1500	825	35.3	22' 4'	6' 7	...		.		.	...
	Pacer 115 (PA 20)[26]	4	1 Lyc 0-235-C1@108		74	125	112	50[27]	...		600	580	1750	920	29' 3	20' 4'	6' 2½"	...		.			...
	Pacer 125 (PA 20)[26]	4	1 Lyc 0-290-D@125		74	135	125	48[27]			810	580	1800	970	29' 3'	20' 4	6' 2½"	...				..	.
	Pacer 135 (PA 20)	4	1 Lyc 0-290-D@125	Aer	74	135	134[28]	48			650	625	1800	990	29' 3'	20' 4	6' 2½"	...				..	...
Ryan Aeronautical Co. San Diego, Calif.	Navion Utility 205	4	1 Con E 185-3@205	Aer	85	157	150	54	875	875	830	500	2750	1721	33' 4½"	27' 3"	8' 7 5/8"	1AP 2USG 3; 4,5, 6SW 7KS 11, 12SW, 16USG	RCA	Gr		DR	9485
	Navion De Luxe 205	4	1 Con E-185-3@205	Har	84	163	155	54	875	875	400	500	2750	1782	33' 4½"	27' 3"	8' 7 5/8"	1AP 2USG, 8K, 4,5 6SW 7KS, 9 10Sc; 11, 12SW[29]	RCA	Gr	Gr	DR	10,985
	Navion Super 260	4	1 Lyc GO-435-C2@260	Kop	93	174	170	55	770	875	1250	640	2850	1897	33' 4½"	27' 6"	8' 7 5/8"	1AP 2USG 8K 4 5, 6SW 7KS, 9, 10Sc 11 12SW[30]	RCA	Gr	Gr	Ec	13 985
Sanders Aviation, Inc — Engineering & Research Corp Riverdale, Md.	Ercoupe G[31]	2½	1 Con C-85@85	Sen	74	125	110	48	1850	800	550	530	1400	838	30'	30' 3"	5' 6"	1AP, 3AM, 4, 5, 6, 12SW	Le	Gr		DR	3995
Schroeder Aircraft Rochester, N. Y.	Dragonfoil CX-200-L6	1	1 Con C-65FJ@87	Sen	58	220[32]	180[32]	60	...		1500*	450	820	570	20' 4"	18'	3' 6"	...	.				...
Sperti Aircraft Co Deep River, Conn	8[33]	2	1 Lyc 0-145@75	Sen	60	105	95	52[9]	...		400	250	1000	520	20'	16'	5'	2, 4, 5	...		.	..	1500*
Taylorcraft, Inc Conway, Pa	Special De Luxe	2	1 Con C-65@65	...	72	105	95	38[9]	..		400	350	1000	750	35'	21'	6' 6"	...					2395
	Tourist	4	1 Con C 145@145	...		125	115	36[9]			700		2200	1220	36' 4"	24'	7' 1"	...	.	Gr			4895
	Sportsman	2	1 Con C-85-12@85	...	72	120	110	38		.	700	400	1280	550	36'	22'	6' 6"	...	.	Gr		DR	2950
Texas Engineering & Manufacturing Co., Inc Dallas, Tex.	Swift 125 GC-1B	2	1 Con C-125-2@125	Aer	73	150	140	48	...	...	1000	425	1710	1185	29' 2"	20' 10½"	6' 1"	2 3K, 4, 5AC, 8K, 11AC	GE	Gr		DR	4495

*—approximate
AC—A. C. Spark Plug
AM—Aero-Marine
Aero—Aeromatic
Air—Airofix
Airc—Aircooled
AP—Airpath
Avi—Aviqator
Bch—Beech
Be—Bendix
Con—Continental
DR—Delco-Remy
E—Elgin
Ec—Eclipse
F.A.F.—Fly Away-Factory
GE—General Electric
Gr—Grimes
H—Hallicrafter
Ham—Hamilton Standard
Har—Hartzell
J—Jacobs
K—Kollsman
K-P—Kollsman or Pioneer
KS—King-Seeley
Kop—Koppers
Le—Lear
Lew—Lewis
Lyc—Lycoming

McC—McCauley
Na—Narco
RCA—Radio Corp of America
Sc—Schwien
Sen—Sensenich
SW—Stewart-Warner
USG—U. S. Gauge
1—compass 2-airspeed. 3-altimeter. 4-oil pressure 5-oil temp. 6-tach. 7-fuel gage 8-sensitive altimeter 9-rate of climb. 10-turn and bank. 11-fuel pressure 12-ammeter 13-voltmeter 14-stall warning 15-landing gear indicator. 16-manifold pressure 17-artificial horizon 18-directional gyro 19-clock 20-cylinder-head temp. 21-3-in-1 engine group. 22-engine gage cluster unit. 23-suction gage. 24-emergency fuel pump, 25-vertical speed indicator, 26-outside air temp.

1—No wind S.L. takeoff at gross weight over 50-ft. obstacle
2—No wind S.L. landing over 50-ft. obstacle.
3—Fully loaded and without auxiliary fuel provisions
4—Numeral indicates instrument type. letters indicate maker—see listings at bottom of tables.
5—Plane-car. Made to order only. Production version will have Lyc O-290-D engine rated at 125 hp. at 2600 rpm. fuel capacity 24 gal., fuel consumption 7 gal./hr
6—Also comes with AC hourmeter, speedometer, odometer and engine instruments by SW, DR windshield wiper, horn, Sparks Worthington.
7—Has electrical system with battery. 12-v generator, starter, wiring for landing, navigation and instrument lights.
8—Components for five units being produced
9—Stalling speed
10—Bench engine gage cluster unit with AC fuel pressure, fuel quantity, oil temp, oil pressure, ammeter and MB cylinder head temp gage.
11—Further specs will not be available until completion of flight test program.
12—Or Aeromatic with altitude control
13—Also Kollsman manifold pressure gage, Elgin clock, Lewis Engrg. cylinder head temp, U. S. 3-in-1 gage
14—Also Elgin clock and U. S. Instrument 3-in-one gage
15—Or Sensenich
16—Turbojet unit still under development
17—For C-90, 120 mph. with C-85
18—Over 100 mph. with C-85
19—1850 ft. with C-85.
20—555 fpm. with C-85.
21—Seating on car can be increased to 4
22—Ten sold in 1949
23—Made to order
24—Or Flottorp—prop diameters 60-66 in.
25—73 sold in 1949
26—Performance figures are with plane fitted with slowest turning fixed pitch prop. at gross load and under standard conditions
27—With flaps
28—At 5000 ft. at 75 percent power.
29—And U. S. Gauge manifold pressure. Elgin clock, cylinder-head temp. and Scott outside air temp.
30—Also Elgin clock, U. S. Gauge manifold pressure, Scott outside air temp. and cylinder head temp gage.
31—53 sold in 1949
32—Design speeds
33—Controllable wing flying boat

that 1949 sales are "about as low as possible" and that 1950 planes sales will do at least as well, and probably show slight improvement. Shipments for 1949 by 11 principal manufacturers totaled 3358 planes in the year, slightly more than a tenth of the plane shipments by principal companies in their best postwar year, 1946, when 33,254 planes were shipped.

AVIATION WEEK forecast for personal plane sales for 1950, calls for another slim year with approximately 4000 planes sold.

▶**Liaison Competition**—However, light plane manufacturers may benefit from such assistance as the liaison plane competition which USAF is conducting, in which 14 companies have indicated interest.

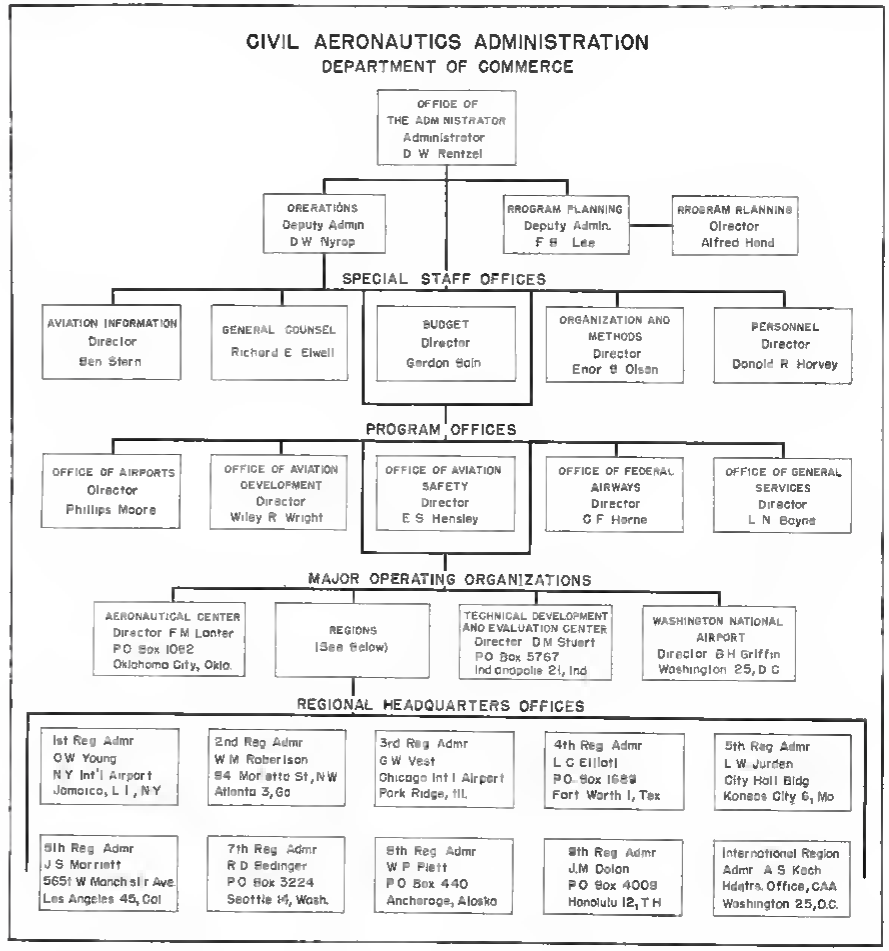
Despite abandonment of one of the experimental twin-engine small plane projects last month (Piper), it is expected that additional business-plane owner interest will be shown in remaining twin-engine small plane developments, both for executive and air taxi and small airline use.

▶**Three Development**—Other interesting experimental developments:

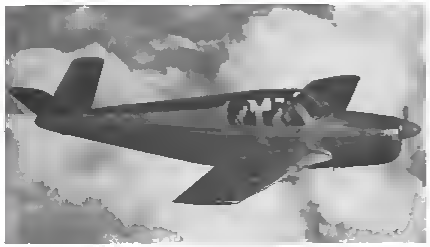
- **Roadable Aircraft.**
- **Agricultural planes.**
- **Planes capable of operating from very limited landing facilities.**

First CAA certification of a roadable aircraft and first marketing experience with such a plane is expected in 1950, when Robert E. Fulton, Danbury, Conn., puts his 150 hp., two-place Fulton Airphibian on the market.

▶**Trailer Component**—Somewhat behind the Fulton plane in certification schedule are two other roadable aircraft, the Hall flying automobile, at San Diego, and the Aerocar of Moulton



Among U. S. Personal & Executive Planes . . .



Beechcraft Bonanza

Ryan Navion Super 260

Cessna 170

Cessna 190

Piper Pacer

Bellanca Cruisemaster

Beechcraft Twin Bonanza

Aeronca Sedan

Taylor, being built at Longview, Wash.

Taylor goes a step farther in his roadable concept than either Fulton or Hall, in that he folds up the flight component of his combination auto-plane into a trailer which hitches on behind his auto, to be towed down the highway. Thus he eliminates airport storage, and permits the weather-grounded pilot to take his wings along on his surface trip, so he can resume flight farther along on his journey under more favorable weather conditions.

▶**Weick Project**—Most promising agricultural plane development is being conducted by Prof. Fred E. Weick at the Personal Aircraft Research Center, Texas A&M College, College Station, Tex. High mortality rate among pilots of low-flying agricultural application planes has resulted in Weick designing crash-protection features into his new craft which may lead to their incorporation in many other types of planes, as well.

Aside from its safety features, the all-metal Weick plane is being developed with assistance of Department of Agriculture and NACA, to provide more efficient spraying, dusting and seeding mechanisms. It will also be designed to operate safely at slower speeds than other fixed-wing agricultural craft.

▶**Helioplane**—In contrast to the government-financed Weick plane is the Helioplane developed by Prof. Otto Koppen of Massachusetts Institute of Technology, and Prof. Lynn Bollinger, formerly of Harvard University, at Boston. It is designed for efficient operation out of airports as small as a tennis court, due to its slots, slats, flaps, geared engine, large efficient propeller, and other features. Following first flights in 1949 of a two-place 90 hp. Helioplane, development is now underway on a larger four-place version, with negotiations underway for its manufacture, probably by Aeronca Aircraft Corp. Plane has been developed on a private capital risk basis.

Proposals for government sponsorship of additional research on improved small airplanes, offered in Congress, were not expected to have sufficient support for passage, as this issue went to press in mid-February.

Private Pilots

State	Number
Alabama	3,740
Arizona	3,734
Arkansas	4,127
California	35,414
Colorado	4,652
Connecticut	2,860
Delaware	672
Dist. of Columbia	1,286
Florida	9,697
Georgia	4,416
Idaho	3,327
Illinois	15,363
Indiana	9,806
Iowa	7,342
Kansas	7,481
Kentucky	3,535
Louisiana	3,459
Maine	2,079
Maryland	2,709
Massachusetts	6,623
Michigan	16,089
Minnesota	6 087
Mississippi	1,884
Missouri	7,533
Montana	2,702
Nebraska	5,072
Nevada	1,096
New Hampshire	1,254
New Jersey	6,250
New Mexico	2,133
New York	13,028
North Carolina	4,669
North Dakota	1,889
Ohio	15,741
Oklahoma	7,223
Oregon	6,712
Pennsylvania	15,482
Rhode Island	968
South Carolina	2,666
South Dakota	1,876
Tennessee	3,887
Texas	19,154
Utah	2,973
Vermont	813
Virginia	4,433
Washington	10,337
West Virginia	2,395
Wisconsin	6 708
Wyoming	1,456
Outside Continental U. S.	3,869
Total	306 699

Source: CAA

AIRPLANES USED IN AGRICULTURE

CAA Region	Operators	Airplanes	Helicopters	Total
1	103	248	14	262
2	209	732	6	738
3	230	768	2	770
4	330	1,034	0	1 034
5	502	921	3	924
6	180	667	27	694
7	166	470	8	478
8	1	0	1	1
9	3	5	2	7
Totals	1,724	4,845	63	4,908

Compiled Jan., 1950
Source: CAA

Aviation training, which dropped sharply in 1948 as indicated by the CAA survey (from 10,353,000 hr. in 1947 to 8,701,000 hr. in 1948) dropped again in 1949, preliminary studies indicate. Prospects for more training in 1950 are not bright, civilianwise, and consequently market prospects for trainer plane sales, divided largely between Piper and Aeronca, are likewise not more than fair.

▶**Military Help**—Another military lift to civilian aviation in the immediate future is a plan to begin civilian operation of an experimental basic flight course for USAF cadets. If the course proves more efficient and more economical as expected, it may result in additional operations of the same kind by civilian schools.

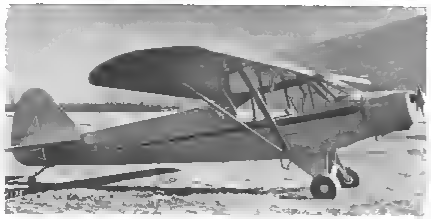
USAF is considering 20 aviation schools as likely sites to establish basic flight training centers. Currently, plans call for only one civilian experimental school operation, with the possibility that a small number of aircraft and engine mechanics will be trained at civilian technical schools.

All 20 schools, most of which operated as USAF training centers during World War II, will be invited to bid for the first contract. If USAF finds the plan successful, other contracts may be awarded.

Still other prospects of military assistance are in proposed training of USAF mechanics in civilian aviation schools and overhaul and repair of USAF planes in civilian maintenance bases, already been started on a limited basis, in connection with the MATS Berlin Airlift operation.

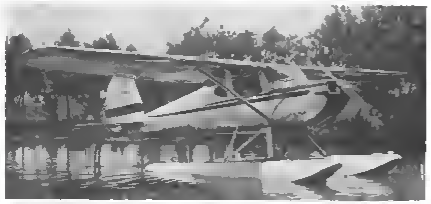
Operating on an economy and efficiency basis, the civilian training and maintenance and repair services to the USAF are planned for a double purpose: to save the U. S. taxpayer money, and to keep in readiness civilian aviation facilities that will be a ready reservoir of trained know-how and available facilities in the event of war emergency.

Among U. S. Personal & Executive Planes . . .



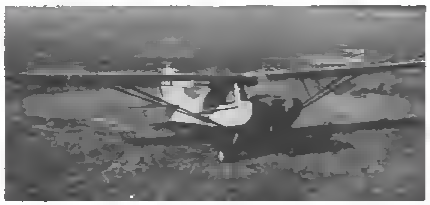
Piper Super Cub

TEMCO Swift 125



Cessna 140

Lecoupe Club Air



Aeronca Champion

Fultou Airphibian

Taylorcraft Sportsman

Ercigh Trojan

Callair

Accidents

Non-air carrier safety making slow progress, CAB analysis shows.

Aviation safety in the non-air carrier field, is making continuing slow progress according to the CAB analysis of accidents during the year 1948, the last year for which complete figures now are available.

A numerical decline in total accidents from 1947 figures (7850 as compared to 9253), and in fatal accidents (850 as compared to 882), is believed partially due to improved safety education and enforcement on both state and national levels, although the decline was also partially caused by an estimated decrease in the amount of flying in 1948.

▶ **Stalls the Killers**—Surprisingly, despite the emphasis on elimination of stalls by use of stall-warning indicators and stall-proof planes, the stall accidents still accounted for 416 (49 per cent) of the 850 fatal accidents, identical with 1947 stall accident percentage, and of all stall accidents 35 per cent were fatal, as compared with only 33 percent in 1947. (CAA estimates as of the close of 1949 that 10,500 planes are either stall-warning equipped or stallproof design, approximately 12 percent of all certificated planes.)

How seriously the violations of Civil Air Regulations are reflected in accidents is shown by the fact that violations of the regulations were present in 54 percent of the 850 fatal accidents. Reckless flying was charged in 365 of the fatal accidents and in a total of 855 accidents, flying below minimum prescribed altitudes was charged in 224 fatal accidents and in a total of 485 accidents. (Some insurance analysts have contended for several years that high accident rates in non-carrier aviation can be attributed very largely to the relatively small adventuresome group of 'buzzboy' pilots, and show analysis of safe-and-sane pilot's accident-free records to substantiate the contention.)

Aircraft destroyed in accidents totaled 2191 as compared to 2554 the previous year, and 825 of the fatal accidents resulted from these plane washouts.

▶ **Shifting Pattern**—Increase in commercial flying and decrease in instructional flying was reflected in shifts of these two categories in relationship to the total number of accidents. Instructional flying accounted for 2843 of the accidents, as compared to 3686 in 1947, with a drop in fatal accidents from 252 to 197.

The decrease is attributed largely to decrease in instructional flying, but probably some is attributable to better safety in instruction.

Non-commercial flying, including pleasure flying and personal transportation, and plane ferrying and test flying where no direct fees are charged, resulted in 55.2 percent of all non-air carrier accidents (4307 out of 7850), and 66 percent of all fatal accidents (551 out of 850).

Commercial flying including passenger and cargo carrying, crop control, photography, exhibition, testing, ferrying, etc., accounted for 76 fatal accidents and a total of 569 accidents, as compared with 82 and 660 in 1947.

▶ **What Kind**—Types of accidents for 1948 were classified as follows: landing, takeoff and taxiing 3374; collisions with objects other than aircraft (trees, buildings, wires, etc.) 2665; stalls, 1184; collision of two aircraft, 226; fires incident to flight 33; airframe failure 201; miscellaneous, 98; undetermined, 25; propeller accidents to persons, 44.

Primary accident causes were listed as follows: pilot error, 5855; powerplant failure 652; weather 468; terrain, 304; landing gear failure 220; other personnel 207; airframe failure, 59; equipment & accessories, 2; related equipment, 2; miscellaneous, 15; undetermined, 47.

Analysis of records of pilots in accidents shows that the pilot age group from 20 to 24 are the most serious offenders with those 25 to 29 next, and that the pilot experience group with 51 to 100 hr. is almost equally as bad as the next class with 101 to 300 hr. These two experience groups together account for over 50 percent of the accidents in the categories involving violations of reckless flying, flying below minimum altitudes and acrobatics below minimum altitudes.

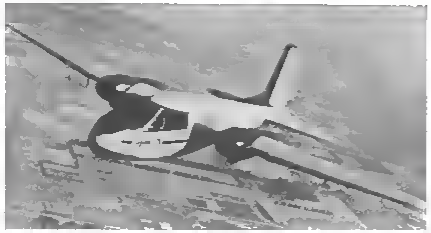
License Fees Set For Crop Sprayers

California pilots employed to spray crops by air with insecticides and weed killers must pay a $25 license fee and pass a state examination in pest control work under new state department of agriculture regulations.

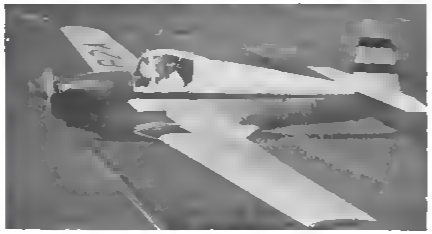
The rules were drawn at the direction of the state legislature, which acted in response to complaints of increasing damage to crops and injury to livestock from faulty or negligent application of pest control materials.

Under the new regulations county permits are required for each commercial application of herbicides and in certain "hazardous" areas for each application of more than a pound of the chemicals prohibited by the permits.

Among U. S. Personal & Executive Planes . . .



Baumann Brigadier 250



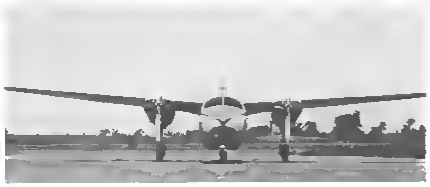
Mooney M-18l

Johnsm Bullet 185

Colonial Skimmer

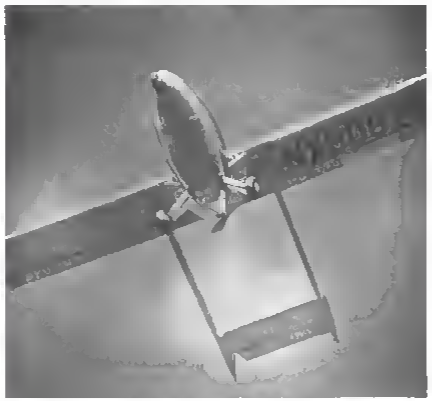
Morrsey Nifty

Jamieson Jupiter



Aero Commander

Taylor Aerocar



Anderson Greenwood AG-14

Air Power Boosted by Increasing Airports

CAA program, gaining momentum, will use all present funds by June.

Construction expenditures on U. S. airports rose markedly during 1949, figures point to a construction outlay exceeding $100 million for the 12 months.

CAA expenditures are a good yardstick. In 1949, CAA paid out $46.3 million for work accomplished on airports—more than twice the $21.9 million expended the previous year. Matching fund expenditures by the local sponsors of the projects ran ahead of the CAA payments.

The high rate of construction expenditures will continue. By June 30, CAA will have used up nearly all the $85 million in cash so far appropriated for aid to airports. In addition, it will have obligated most of the $62 million contract authority that Congress has voted to date.

►**1951 Program**—For fiscal year 1951, starting next July 1, President Truman in his budget message asked Congress to grant CAA $51.3 million cash to take care of Federal-aid airport commitments and $36.7 million of additional authority to enter into contracts with local sponsors for airfield construction. These sums, if granted, will keep the airport program going at the quickened pace of the last 13 months. Of the $36.7 million added contract authority, $25 million would go to 86 large airports that have enough traffic to justify control towers.

To show how the Federal-aid airport program is moving, CAA during 1949 made grant offers totaling $34.3 million for 460 screened and approved projects. In the same twelve months it entered into contracts with local sponsors for 470 airport construction jobs that would get $37.9 million of federal aid. Nearly 200 of the grant offers were for class IV and larger airports.

More and more the big money is going to larger airports. To date CAA has allocated $134 million for airport projects (of which $97 million has advanced to the grant offer stage). Class IV and larger airports get 70 percent of this money. Based on the allocations so far made, the total program to Dec. 31 for airport construction, including the sponsors' contributions, tops $275 million.

Classes of Airports by States

(As of Jan. 1, each year)

(Data covers existing airports recorded with the CAA)

State	TOTAL	CLASS					
		Sub I and I[2]	II	III	IV	V	VI and Over
Alabama	91	47	16	13	12	1	2
Arizona	179	68	50	32	14	13	2
Arkansas	88	57	11	11	8	1	0
California	509	278	88	49	37	33	24
Colorado	109	57	23	20	1	2	6
Connecticut	34	25	1	3	4	1	0
Delaware	17	11	3	0	1	0	2
Dist. of Columbia	3	0	0	0	1	1	1
Florida	191	54	24	46	40	12	15
Georgia	134	64	17	24	22	3	4
Idaho	124	107	11	7	2	0	3
Illinois	173	113	42	5	9	4	0
Indiana	160	112	29	8	9	2	0
Iowa	183	152	19	4	7	0	1
Kansas	190	127	25	17	4	9	8
Kentucky	67	54	4	4	3	1	1
Louisiana	79	40	14	12	8	2	3
Maine	65	41	6	12	2	2	2
Maryland	51	24	14	5	6	0	2
Massachusetts	81	54	8	9	7	0	3
Michigan	259	173	48	14	11	2	2
Minnesota	127	83	31	7	4	1	1
Mississippi	87	48	17	12	9	0	1
Missouri	121	79	21	12	5	3	1
Montana	109	72	18	7	6	2	4
Nebraska	137	102	16	4	2	2	11
Nevada	66	28	7	11	10	9	1
New Hampshire	36	26	4	3	2	0	1
New Jersey	94	64	16	8	4	0	2
New Mexico	108	65	13	6	9	8	7
New York	267	206	29	11	14	5	2
North Carolina	166	96	14	18	12	2	4
North Dakota	133	107	15	5	6	0	0
Ohio	252	189	41	10	8	2	2
Oklahoma	148	89	25	12	13	6	3
Oregon	117	76	11	11	14	4	1
Pennsylvania	218	161	35	14	7	1	0
Rhode Island	11	6	1	2	0	2	0
South Carolina	65	28	13	4	11	6	3
South Dakota	69	51	6	5	3	2	2
Tennessee	74	44	15	6	5	1	3
Texas	647	392	114	54	52	25	10
Utah	60	22	15	13	4	5	1
Vermont	23	19	0	3	1	0	0
Virginia	125	83	17	10	11	2	2
Washington	178	116	23	10	17	5	7
West Virginia	59	46	7	2	3	1	0
Wisconsin	172	120	36	11	3	1	1
Wyoming	57	28	13	11	2	2	1
Total	6,484	4,100	1,027	576	447	185	149

Sub I airports are those which exist but do not come up to class I standards
Source: Civil Aeronautics Administration.

For the Federal-aid airport program, now in its fourth year, Congress has authorized appropriation of up to $520 million over a seven-year period ending with fiscal 1953. With local matching funds, the full program—if Congress carried it out to the limit of authorized appropriations—could develop more than $1 billion of airport construction. But so far, Congress has furnished a total in four years of only $157 million in cash and contract authorizations.

►**Work Underway**—CAA at the end of the year had 311 projects under construction, involving $39.5 million of federal aid. Of these projects 178 were 76 to 99 percent complete, 48 were 51 to 75 percent, and 38 were 26 to 50 percent. On the remaining 47, work was 1 to 25 percent completed.

Alaska airports moved ahead during the year. The two 100-percent federal

Type of Airports by States

Jan. 1, 1950
(Data covers existing airports recorded with the CAA)

STATE	TOTAL	TYPE				
		Municipal	Commercial	CAA Intermediate	Military	All Others
Alabama	92	32	32	2	15	10
Arizona	179	42	31	4	30	72
Arkansas	88	32	38	0	0	18
California	509	152	178	8	44	127
Colorado	109	54	33	3	3	16
Connecticut	34	10	24	0	0	0
Delaware	17	2	12	0	1	2
Dist. of Columbia	3	0	2	0	2	1
Florida	191	90	47	1	48	5
Georgia	134	54	33	4	10	33
Idaho	124	71	14	3	1	35
Illinois	173	32	113	3	6	19
Indiana	160	34	114	1	4	7
Iowa	183	52	77	2	2	50
Kansas	190	57	56	3	9	25
Kentucky	67	14	35	1	2	15
Louisiana	79	28	23	4	4	20
Maine	65	25	30	0	3	7
Maryland	51	5	28	0	7	11
Massachusetts	81	22	52	0	4	3
Michigan	250	118	105	8	5	22
Minnesota	127	79	45	0	1	2
Mississippi	87	33	30	4	6	14
Missouri	121	47	59	5	3	7
Montana	109	69	14	8	1	17
Nebraska	137	67	43	3	1	23
Nevada	66	21	20	6	3	16
New Hampshire	36	12	17	0	1	6
New Jersey	94	13	70	0	5	6
New Mexico	108	31	30	12	8	28
New York	247	48	136	2	6	75
North Carolina	146	36	85	1	12	12
North Dakota	133	60	38	6	0	29
Ohio	252	38	176	4	4	30
Oklahoma	146	80	50	1	4	13
Oregon	117	42	38	2	0	35
Pennsylvania	218	43	161	2	5	7
Rhode Island	11	2	7	0	2	0
South Carolina	65	36	18	2	6	3
South Dakota	69	42	22	1	1	3
Tennessee	74	21	39	6	2	6
Texas	647	169	152	13	51	262
Utah	60	37	7	8	4	4
Vermont	23	9	12	0	1	1
Virginia	125	24	63	2	14	22
Washington	178	67	53	4	12	42
West Virginia	59	14	27	2	0	16
Wisconsin	172	60	86	2	0	24
Wyoming	57	33	12	5	0	7
Total	6 484	2,200	2,585	139	353	1,207

[1] Airport type definitions: Commercial—Public use and public service, privately owned and operated. Municipal—Public use and public service, municipally owned and/or operated. CAA Intermediate—Public emergency use, no service. CAA operated. Military—Public restricted, military operated. All others—(a) Public emergency use only, no public services, privately owned for personal use. (b) Public emergency use only, no public services. Government-owned Forest Service, etc. Source: Civil Aeronautics Administration.

fields at Anchorage and Fairbanks were right on schedule in January, with construction of each at the half way mark. In 1949 Alaska also entered the Federal aid program for the first time, after the territorial legislature passed enabling legislation. At the year's end CAA listed tentative allocations for eight projects at six Alaska fields.

Legislatively, CAA hopes that Congress soon will extend the airport program beyond June 30, 1953. Cities have to look farther ahead than three years on airport construction. Larger fields especially have to be built in stages over an extended period. The agency also favors legislation to allow Federal aid for land acquisition in the same measure as for construction.

In its National Airport Plan for 1949, CAA indicated that 4977 airports should be built or improved. Of these, 2183 are existing airports and 2794 are new. They include 567 airports of Class IV or larger. Total estimated cost would be $1.1 billion.

Avionic Spending and What It Buys

SOURCE	Fiscal 1949	Fiscal 1950	Fiscal 1951	Purpose
USAF	$ 49,908,920	$120,675,890	$115,000,000	Electronics
	62,000,000	150,000,000	125,000,000	GFE avionic equipment for new aircraft procurement
	80,000,000	80,000,000	75,000,000	Avionic research and development at private institutions
	7,500,000	6,000,000	7,000,000	GFE avionic equipment for guided missile procurement
Navy	32,000,000	55,000,000	65,000,000	GFE avionic gear for piloted aircraft procurement
	15,000,000	16,000,000	38,000,000	Avionic gear for shipboard installation
	7,918,680	2,847,000	26,650,000	Avionic gear for retrofit aircraft modernization program
	13,000,000	14,000,000	16,000,000	Research on avionic problems basic and applied
	1,220,000	1,400,000	1,800,000	GFE avionic gear for pilotless aircraft procurement
CAA	6,238,689	29,396,556	21,725,189	Establishment of air navigation facilities
	4,232,942	7,747,092	11,063,752	Establishment of air traffic control facilities
	4,786,042	5,281,496	6,746,838	Establishment of aeronautical communication facilities
	1,648,564	1,256,624	1,269,759	Avionic development, service testing and evaluation
ANDB	100,000	7,000,000	10,000,000	Research and development on airways facilities
Bureau Standards	3,042,370	3,100,000	3,150,000	Radio propagation research
Scheduled Airlines	1,500,000	3,500,000	5,000,000	Installation of ground and airborne avionic equipment
Civil Aircraft	500,000	1,000,000	1,500,000	Installation of airborne avionic equipment
Export	1,000,000	1,500,000	2,000,000	Miscellaneous
TOTAL	$296,596,207	$505,704,658	$531,905,538	

Avionics: New Segment of Air Power

By Robert McLaren

Avionics, annually worth half a billion dollars, has changed the definition of the "aircraft business." The once-restricted scope, which included only those who built and flew airplanes, has now been broadened to include vast electrical manufacturing establishments small specialty companies and a varied assortment of research, development and consultation groups, all essential components of today's "aircraft business"

Huge bulk of avionics business—more than 99 percent, in fact—is done with the U. S. government, and the Air Force is the biggest customer Navy and Civil Aeronautics Administration follow in that order in the volume buying list. Civil expenditures, including scheduled airlines, nonscheduled carriers, personal aircraft and export, amount to about $5 million annually, or less than 2 percent of the total

▶ **What Is Avionics?**—Aircraft have always been dependent on electricity for operation. Now, they are equally dependent on electronics for guidance and control. It is thus inextricable welding of aviation and electricity that has brought about avionics, a market including electronic equipment, such as radio and radar, generators, motors, airborne and surface equipment. This airplane of the second half of the twentieth century will be wholly imprisoned by a vast mesh of avionic chains which will anchor its guidance and control to the ground

To get an idea of the phases of the avionics business, picture an hour-glass the upper portion contains the research activities, the neck is the buying agent, and here research findings are filtered, controlled and their applicability is determined. The lower part of the glass contains the procurement and production functions of the business

Avionics procurement, design and control are most clearly delineated by technical function rather than by administration

● **Electrical equipment**—As always bulk

of this material is determined by the airframe company electrical engineer and bought through the airframe company purchasing office. Such items as starters, generators, batteries, circuit breakers, control motors, switches, relays and wiring are determined by the Electrical Group of the Engineering Department of the airframe company. In general, these items are supplied by the airframe manufacturer as cost items on airframe contracts, although major units, such as starters and generators, are obtained directly from the contractor as Government Furnished Equipment. All other electrical equipment is specified by the engineer and purchased locally. Associated with this purchasing function is test equipment operated by the airframe company for purposes of insuring that vendor items meet specifications and performance claims. The electrical laboratory also develops and tests company-conceived circuits and systems for which special electrical items must be developed by local suppliers. This equipment while substantial dollar-wise (about $25 million), amounts to only about 5 percent of the total avionic expenditure.

● **Communication Equipment**—Electronic equipment is generally the responsibility of the procuring agency. This includes such airborne equipment as command transmitters and receivers, range and beacon receivers, marker, localizer and glide path receivers, direction finding equipment and such special VHF and UHF equipment as may be specified by the procuring agency. All of this equipment without exception, is determined by the contracting agency, is furnished by them and, frequently, is even installed by them. The airframe engineer provides only power supply, wiring and installation provisions for communication equipment. This equipment is furnished to procuring agencies as a line of endeavor wholly separate from aircraft procurement with its own research and development program, test laboratories and procurement specifications. The manufacturer of this equipment rarely knows what kind of airplane in which his equipment will ultimately be installed.

● **Airborne Radar**—Such vital functions as identification, gun laying and tracking, bomb aiming, air intercept search and guidance are performed by this equipment, all of which is government-procured and furnished the airframe company as classified GFE items. It is in this field that the airframe company engineer has the least to say in determining type, installation, function, size or weight of the equipment he must install, or make provisions for. This equipment is designed, furnished, tested and approved wholly by the procuring agency and represents a substantial portion (about 20 percent) of the current expenditure for avionic equipment.

● **Air Defense**—Under this heading lies the broad program for a continental air defense system (including a radar early warning net along the Canadian border, initial expenditures for which have already been authorized), shipboard early warning, air defense gun laying and air defense control systems. This field is clearly the responsibility of the government, and private enterprise has no function in this program other than the development and production of such equipment upon request. This represents about 25 percent of current expenditures.

● **Navigational Aids**—This is the largest field of avionic activity at the present time with about 50 percent of the total expenditure going to research, development, production, installation and operation on the ultimate common air navigation system, which will eventually cost more than $1 billion. This ground equipment program is entirely the function of the government, including the Air Force, Naval Aviation, Army Ground Forces and the Civil Aeronautics Administration.

► **Program Coordination**—In the field of electrical equipment, coordination is obtained through the media of equipment standards, such as are established by the Institute of Electrical Engineers, American Society for Testing Materials, American Standards Assn., National Electrical Manufacturers Assn., Society of Automotive Engineers, Underwriters Laboratories, AIA National Aircraft Standards Committee and individual company standards. Coordination of such standards work is obtained through the Aeronautical Standards Group and the Aircraft Committee, both of the Munitions Board. Such "ANC" and "AN-C" standards, together with those of the Federal Specifications Board of the new General Services Administration comprise the requirements that must be met in government procurement.

Other than the use of such standard parts, materials, practices and test codes and the meeting of procurement agency requirements in such matters as the functions and types of equipment that must be supplied, the airframe electrical engineer is free to design and equip the electrical system of the airplane.

In the fields of communications and airborne radar, coordination again is obtained according to function. Fundamental authority over combat avionic equipment is held directly by the Joint Chiefs of Staff through their Communications and Electronic Committee. This broad planning group establishes basic tactical requirements for future avionic equipment and Air Force-Naval Aviation-Army Ground Forces coordination is assured at this top echelon of command.

Requirements are then studied by the Committee on Electronics of the Research and Development Board, which establishes and coordinates research and development programs aimed at creation of the necessary equipment. Following creation of a suitable article, the requirements and cognizance are transmitted to the Joint Communications and Electronic Equipment Committee of the Munitions Board, which interprets in the form of procurement planning and production mobilization. In this way, common research, development and procurement of airborne avionic equipment for both services is assured.

► **USAF Responsible**—Air Defense is entirely the cognizance of the Air Force and all statement of requirements, research, development, procurement, installation and operation is solely the function of the USAF. Through membership on RDB and Munitions Board committees, the Navy and the Army participate in the formulation of these programs as well as contribute technical guidance in the furtherance of the development program.

Navigational aids development program, because of its broad scope, is coordinated by a special group. The Air Navigation Development Board, which formulates a research and development program to serve the needs of civilian and non-tactical military aviation, but capable of useful integration with any air defense system established by the National Military Establishment.

► **Technical Status**—Virtually limitless funds, top priority for technical personnel and extreme urgency of the World War II period produced rapid scientific progress in avionics. Radar was transformed from simply a basic idea with a few experimental developments into an entirely new method of waging war. So rapid was scientific progress that vast quantity production of accurate, dependable and efficient radar equipments was possible early in the war and by the middle of the war there was no combat ship or combat aircraft that did not carry one or more radar devices into action against the enemy.

With V-J Day, money stopped, scientists and engineers disbanded, projects were hastily concluded or abandoned altogether and the tremendous endeavor of radar halted. Immediate postwar years witnessed severely-handicapped efforts to salvage the knowledge, techniques and equipments of the wartime advance. Money was scarce even in the services. Future requirements were muddled and the entire field was compromised by millions of dollars worth of surplus equipment that economy-

minded armed forces determined to make-do.

One problem created by the end of the war was the fact that all radar research and development had been carried out in utmost secrecy, for obvious reasons. As a result, the tremendous reservoir of radar knowledge was effectively sealed up in highly classified government reports. For this reason these data were not available to the bulk of the avionics industry as it began to move forward again, at a sharply reduced rate, in the application of war-developed techniques to peacetime uses.

It was not until 1947 that the decision came to declassify and publish research reports of the M.I.T. Radiation Laboratory, at which wartime radar research was concentrated. This huge project was carried out jointly by the U. S. government and the McGraw-Hill Book Co. and publication of these data in wholly unclassified form made available results of the wartime progress.

► **Results Coming Now**—Although funds are still limited, much of these wartime data are beginning to bear fruit. Research programs, based on these techniques, have already developed entirely new equipments not available during the war. Wartime items have been greatly improved, range and fidelity increased and weight, size and cost reduced.

Today, avionics is ready to get under way. Government procurement of production items is now being undertaken. Research programs of the past two years are now at fruition in production items. Long sought systems of aircraft communication and navigation are materializing and air defense systems are expanding.

Major impetus to this program has been development of an "ultimate common air navigation system," one of the most remarkable planning jobs in technical history. Here, for the first time, is a step-by-step program leading towards an ultimate goal which is clearly defined, a blueprint for technological progress unmatched in the history of any other technical field. It is the work of a group of military and civilian experts comprising Special Committee 31 of the Radio Technical Commission for Aeronautics.

With this blueprint on the one hand and all of the wartime research results on the other, both supported by a confident Congress, the avionics industry has an expansive future ahead. The industry today is receiving orders at the rate of a half-billion dollars annually. It is rational to predict for the very near future a billion-dollar annual avionics business for the industry that was not born until 1942 and not recognized until 1949.

Chronology

1926—Implementation of Federal Airways established as responsibility of the Department of Commerce.

1938—Civil Aeronautics Authority created and assumes responsibility for Federal Airways.

1940—Civil Aeronautics Authority reorganized into Civil Aeronautics Board and Civil Aeronautics Administration, the latter retaining responsibility for Federal Airways.

1947—Mar. 18—Joint Research and Development Board creates Ad Hoc Committee on Navigation.

Apr. 28—Air Coordinating Committee requests study of air navigation problems by Radio Technical Commission for Aeronautics.

June 12—Radio Technical Commission for Aeronautics establishes Special Committee 'SC 31—Air Traffic Control.

June 15—President's Special Board of Inquiry on Air Safety created by President Truman.

July 18—President's Air Policy Commission created by President Truman.

July 30—Congressional Aviation Policy Board created by Public Law 287 (80th Congress) signed by President Truman.

Sept. 24—Ad Hoc Committee on Navigation retained in reorganization of JRDB into Research and Development Board.

Dec. 29—Report issued by President's Special Board of Inquiry on Air Safety.

1948—Jan. 13—President's Air Policy Commission issues report "Survival in the Air Age."

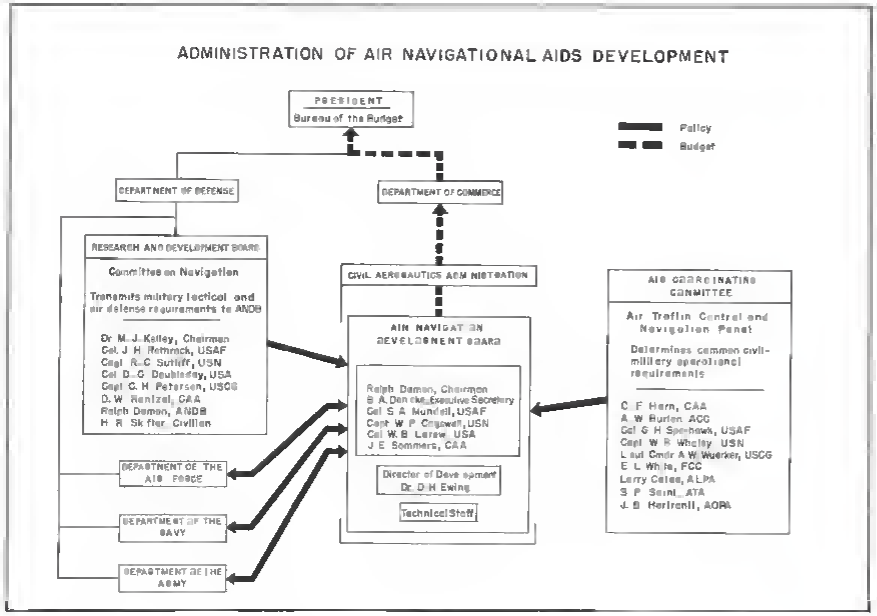
Feb. 17—RTCA "SC-31—Air Traffic Control" submits report to RTCA Executive Committee.

Mar. 1—Congressional Aviation Policy Board issues report "National Aviation Policy."

Mar. 5—RDB Ad Hoc Committee on Navigation issues report "Navigation and National Security."

May 17—Secretary of Defense Forrestal and Secretary of Commerce Sawyer concur in recommendations by RDB Ad Hoc Committee on Navigation that joint board be established to coordinate air navigation development.

Nov. 2—Air Navigation Development board created by special charter approved by Secretaries of Defense and Commerce.



How ANDB Fits into Air Power Needs

Board charged with creating navigation system for all military and civil demands.

Sole responsibility for working out the ultimate common air navigation system of the United States is in the hands of the Air Navigation Development Board, which prepares the programs, awards the research and development contracts and coordinates the nation's progress towards a truly "all-weather" system of air navigation.

Composed of an Air Force, Navy, Army and Civil Aeronautics Administration member but with a private citizen as chairman—the Board is responsible directly to the Secretary of Defense and the Secretary of Commerce. It receives its own funds from Congress. Its decisions are unanimous and binding on its member agencies.

It is, in short, the "boss" of a national effort that eventually will involve the expenditure of more than $1 billion in an effort to remove forever the menace of weather to flying.

▶ **Members**—Chairman of the Board is Ralph S. Damon, president of Trans World Airlines, who serves without pay, other than expenses associated with meeting attendance. Damon served as chairman of the Research and Development Board Ad Hoc Committee on Navigation, which recommended establishment of ANDB. His association with the formulation of the Board, plus his intense interest and long association with efforts to solve the air navigation problem, made him a logical choice to head the new group.

Air Force member is Col. Sam A. Mundell, who long has been associated with Air Force communications development. He served during the war as Communications Officer with the 8th and 12th Fighter Commands and was a member both of the RDB Ad Hoc Committee on Air Navigation and the Radio Technical Commission for Aeronautics SC 31 groups. He therefore, is intimately acquainted with the formation of the new Board and with the SC 31 blueprint.

Naval Aviation member is Capt. Wilson P. Cogswell, naval aviator, who for many years has concentrated on naval aircraft radio and electronic equipment and operation. He commanded the carrier Shangri-La at the Bikini atomic bomb test.

Army member is Col. Walter B. Larew, who served during the war as Signal Officer of various Fighter Commands and was director of the Air University Communications School for four years prior to his assignment to ANDB.

CAA member is John E. Sommers, who has been with CAA and its predecessor agencies in a variety of assignments, including Deputy Administrator, since 1927. He served as Civil Air Advisor to the Military Governor in Germany in 1945.

Executive Secretary of the Board is Bert A. Denicke, who has had a long career as copilot, flight radio operator and dispatcher for various airlines and became CAA Chief Airway Traffic Controller in 1941. During the war he established air traffic control and air-area rescue control facilities in a variety of Pacific locations and served as Technical Assistant to the Director, CAA.

Airways Operation Service. In August, 1947 he was assigned to the CAA Administrator's office on preliminary work which led to the establishment of ANDB.

Assisting the Board is a technical staff headed by Dr. Douglas H. Ewing, Director of Development. During the war he worked in various capacities at the Massachusetts Institute of Technology Radiation Laboratory, including Chairman of the Overseas Office of the lab and, following the war, he managed the Advanced Development Section of the RCA Victor division. He heads a staff of five exceptionally well-qualified electronics engineers.

▶ **Formulate and Coordinate**—Purpose of the Board is to formulate, and from time to time modify as it may deem necessary, a unified program for research and development of aids for a national system of air navigation and air traffic control to serve the needs of civilian and non-tactical military aviation, but being capable of useful integration with any air defense system established by the National Military Establishment. Once having developed such a program, it has the responsibility of supervising and conducting all common system research and development projects.

The Board is the central coordinating and executive group of the vast and intricate avionic activities in the air navigation field. Principal responsibility is to integrate civil and military air navigation requirements into a common system, insofar as possible. It is assisted in this work by a variety of other groups, whose functions are solely those of advice and guidance. ANDB is a wholly autonomous body which, alone of the various groups involved in the program, has executive powers to authorize projects and spend money. These powers, however, are in the research and development field only and once an item of equipment has reached the production stage its procurement, installation and operation then becomes the responsibility of the member agencies.

With respect to avionic needs, military aviation is divided sharply into tactical and non-tactical aviation. Air navigation problems of MATS and other such air transport operations of the services early were found similar, if not identical, to those of the scheduled airlines. So it was most convenient to lump civil and non-tactical military aviation into a common set of operational problems. This joint group, together with privately-owned aircraft, comprise the users of the "common" air navigational system.

▶ **"Nav-Panel"**—Requirements for air traffic control and air navigation systems, procedures and equipment for this group, are formulated by the Air Coordinating Committee through its Air Traffic Control and Navigation Panel. This "Nav Panel" is made up of a member from the Air Force, Navy, CAA, Coast Guard, Federal Communications Commission, Aircraft Owners and Pilots Assn., Air Line Pilots Assn., and the Air Transport Assn. This group determines common civil-non-tactical military operational requirements. It is assisted in this work by the Radio Technical Commission for Aeronautics, a group established in 1935 by the Department of Commerce to provide technical advice from organizations using air navigational facilities or producing equipment for such facilities to aid the Department in carrying out its responsibilities for the Federal Airways System. RTCA does not maintain a permanent organization but establishes special committees of its members upon request to study specific problems. These special committees cease to exist upon delivery of their final report. RTCA functions most often as a subcommittee of the Air Coordinating Committee, which assigns it most of its problems.

Having obtained the report of its "Nav-Panel" and/or RTCA, ACC coordinates these with pertinent International Civil Aviation Organization requirements particularly as they relate to U. S. commitments to this organization. ACC recommendations are then submitted to ANDB as the best view of civil and non-tactical aviation organizations on the problem considered.

▶ **Military Requirements**—In the field of tactical military aviation and the air defense of the nation requirements are established by the Research and Development Board through its Committees on Navigation and Electronics. These committees are made up of representatives from Army, Navy, Air Force, Coast Guard, CAA, ANDB and qualified civilian members. The Committee on Electronics is responsible for research and development of combat equipment, control systems, special anti-submarine warfare devices, etc. The Committee on Navigation is responsible for research and development on air warning and air defense navigation and traffic control requirements and equipments.

In the event of a national emergency the air defense of the nation requires that there exist facilities for observing, identifying and controling all aircraft movements within our strategic boundaries. Implicit in this requirement is the need for a network of surveillance radar whose location is primarily determined by air traffic requirements but which will be available for military purposes.

▶ **Framework**—Therefore, it is clear that a common air navigational system must

be constructed on a basic framework of air defense requirements. Such requirements are furnished the Board by the RDB Navigation Committee. These air defense requirements are then compared with the operational requirements furnished by the ACC Nav-Panel. It is the integration of these separate and sometimes divergent requirements that comprises the principal coordination problem of the ANDB.

Purely for purposes of housekeeping ANDB is located physically in the Civil Aeronautics Administration. Its budget is submitted through CAA and the Department of Commerce to the Bureau of the Budget and Congress. CAA assists in contracting, inspection and legal aspects of the Board's research program merely as a regularly established channel for the conduct of government business. The ANDB budget is also reviewed by the Research and Development Board so its expenditures can be coordinated with the maximum amount of research and development effort and facilities available to the National Military Establishment.

▶**SC-31 Is Guide**—The ANDB technical program is based upon the use of the SC-31 report as an initial guide plan. However, this plan will be subject to continuous modification in line with changes and advances in avionic science. During the winter of 1948 and the spring of 1949 the RDB Navigation Committee made an examination of all existing military navigation projects to determine which were "tactical" and which could be considered "common system." This work was completed in June, 1949 and some 60-odd projects were declared "common system" and referred to ANDB for consideration. Since that time ANDB has been investigating these projects to determine which should be continued and which should be discontinued or modified.

Recently ANDB held a series of meetings to allocate areas of responsibility among the member agencies for current and future developments, and preliminary agreement was reached on several current and future projects. The Air Force was given cognizance for research and development on Omni Bearing Distance Evaluation, Distance Measuring Equipment, Precision Approach Radar, Navigational Aids Evaluation, Airport Surface Detection Equipment, 1000 mc Omnirange and ILS, and Primary Radar. The Navy has cognizance of Picture Storage Tubes, Secondary Radar, Transponders and Antenna Research. CAA is assigned VHF Omnirange, ILS, Course Line Computer, Airport Time Utilization Equipment and Terminal Aids Evaluation. The Army will carry out research and development work on 1000 mc tubes and circuits.

▶**ANDB Studies**—ANDB reserves for itself work on traffic control and other basic studies. To carry out this work the Board has awarded three research contracts with private institutions. Cornell Aeronautical Laboratory has received two, one contract for a study in connection with Airport Time Utilization Equipment and another for a study of probable characteristics of aircraft some ten or 15 years hence. The third contract is with the Franklin Institute for a study regarding the desirability and practicability of building a complete air traffic control system simulator.

Normally, the Board's direct contracting activity will be restricted to studies and all actual development work will be accomplished through one of the four participating government agencies. No agency or group of the National Military Establishment or the Department of Commerce can initiate or maintain any research or development projects on the common system or any part thereof without the express authorization of the Board.

How It Stands

Run-down on status of component parts of the navigational aids plan.

Research and development have been completed on these components of the Air Navigational Aids Development Program system:

- **VHF Omnirange**—CAA has virtually completed the installation of its entire program of 409 omnirange stations. Most units already are in full time operation but a few are undergoing final installation check.
- **Instrument Landing System**—A total of 94 systems has been installed by CAA, with 38 additional units in the process of installation. Additional 145 units are scheduled for installation during fiscal 1951 and 1952.
- **Distance Measuring Equipment**—Seven experimental units are now in operation and delivery on production equipment is expected to begin in September. CAA plans installation of 396 units as rapidly as delivery will permit. Ultimate plan calls for installation of DME units at each omnirange and ILS site, a total of about 560 installations.
- **Course Line Computer**—Three types, including one developed by CAA have been thoroughly flight tested and their accuracy approved. Minneapolis Honeywell and Collins Radio Corp. are developing production models, soon to be available.

Components of the "transition" phase of the system on which research and development is being pressed so that equipment may be in operation in 1952-3:

• **Transponder**—This equipment will operate in conjunction with secondary radar to furnish ground controllers with aircraft range, azimuth, altitude and identity.

• **Secondary Radar**—Location, height and identity of all aircraft must be given the traffic controllers in a convenient form. This radar will interrogate the airborne Transponder and receive its information outlined above. A common display will be provided for the information received from the secondary and primary radars. Equipment is being developed which will fulfill as many of the operational requirements as possible during the transition period.

• **Airport Time Utilization Equipment**—In order to reduce aircraft congestion and delays in terminal areas it is necessary to regulate properly airway and approach traffic. A study contract has been issued and progress has been very gratifying. Considerable insight has been gained into the manner in which ATUE probably will function and the manner in which individual equipments will be integrated.

• **Airport Surface Movement Indicator**—This equipment will enable airport controllers to see all runways, taxiways and loading ramps under low visibility conditions. Development of this equipment will enable ground controllers to see all aircraft and vehicles on the surface of the airport.

Components of the "ultimate" system on which research and development work is only beginning and much of which is not even in the study phase:

• **Basic Developments**—Before component development can be undertaken, additional basic avionic research information is needed on propagation characteristics of the 960-1660 mc band, channel multiplexing, tube and radio frequency techniques, moving target indicators, aircraft antennae and various information devices.

• **Ground Radar**—Present surveillance radar equipment is not capable of determining altitude as well as bearing and distance unless the airborne transponder is altitude coded and is operating properly. New techniques are required for the solution of this problem of "seeing" unequipped aircraft or equipped aircraft when the equipment is not working.

• **Traffic Control**—Stress is being placed upon the use of universal, simple and lightweight airborne equipment which places a minimum burden upon pilot and traffic controller and which can be produced at minimum cost to the user and the government. Such equipment

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requires studies involving determinations of air traffic control communications, computers, and simulators, aircraft evolution, point to point communications and suitable transponder equipment Preliminary studies have now been under taken for the purpose of solving these problems

• **Display Equipment**—Both airborne and ground displays must be so arranged as to accommodate a maximum of information with a minimum of reading effort on the part of the pilot and the ground controller These requirements necessitate studies of the psychological aspects of the problem, visual data relay, individual displays, integrated displays and the assembly of these individual studies into an integrated program

• **Laboratory Test Equipment**—This is an essential part of the operating system since means must be available for determination of the operating characteristics and fidelity of the various components prior to their being approved for production and use Signal generators, wave meters, slotted lines, spectrum analyzers and other such test equipment operating in the 960 1660-mc band will be required

• **Current Systems Evaluation**—In the past few years, many individual manufacturers have developed composite air navigation systems While none of these systems solves the over-all air navigation problem a considerable amount of research and development effort has been expended and it is essential that the most promising techniques of each development be extracted and applied to the ultimate program

Avionic Standards Program Completed

The armed services electro standards agency has completed its organization and prepared operating procedures for more effective control of electronic standardization activities among the various armed forces groups Established in 1946 the group is headquartered at Ft Monmouth, N J the Army Signal Corps experimental station

The agency is directed by a three-man board composed of Lt Col Thew J Ice USAF, Lt. Col. W E Frame, USA and Capt Henry Bernstein, USN The board is assisted by a technical and clerical staff

Purpose of the agency is to standardize insofar as possible all common electrical, electronic and avionic equipment used by the armed forces This is accomplished by obtaining agreement from the three services on individual specifications for equipment Major problem is obtaining agreement on parts not previously considered standard by more than one agency

Maintaining winter schedules is easier with dependable

EXIDE AIRCRAFT BATTERIES

Air transportation officials, in reporting improved schedule regularity during the winter months, give much credit to efficient electronic aids. Important to their operation are batteries of all-weather dependability. Most of the batteries now in use by all leading airlines are Exides.

In Exide Aircraft Batteries you get dependable performance—the ability to absorb heavy power loads momentarily and to deliver whenever called upon. You get the assurance of long battery life, low cost maintenance—maximum battery economy.

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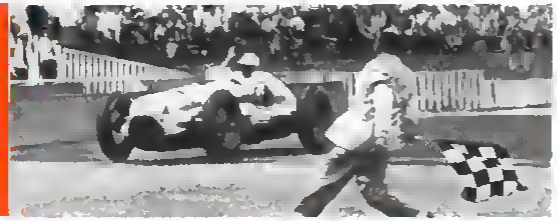
1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

INDIANAPOLIS, MAY 30th
Bill Holland smashes track record with whirlwind 121.327 mph average in 500-mile Memorial Day race. Mobiloil protected engine's full-power performance!



DETROIT, AUGUST 1st
R. Stanley Dollar, Jr. drives his Mobiloil-protected "Skip-A-Long" at a record-breaking pace of 94.285 mph to win the Harmsworth Trophy.

GRAND SLAM FOR Mobiloil

CLEVELAND, SEPT. 3rd
Joe DeBona captures the coveted Bendix Trophy with a new record average of 470.136 mph over 2010-mile transcontinental course. Another win with Mobiloil.

Winners of Land, Sea and Air Speed Classics

Mobiloil Protected

●Mobiloil scored high in 1949—helped keep engines roaring full-throated through grueling miles as U.S.A.'s top racing drivers chalked up new speed records

Get this same protection for your plane! Enjoy greater dependability wherever you fly. Always insist on the winner —*Mobiloil Aero!*

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SIGNS OF SAFETY AND PERFORMANCE

At Over 1,000 U. S. Airports!

Air Power Needs Push Research to Limit

Impatient services and designers can hardly wait for test results.

Aeronautical Research Budget

Agency	Fiscal 1950	Fiscal 1951
Air Force	$233,000,000	$205,072,000
Navy Bureau of Aeronautics	77,553,434	74,775,685
NACA	53,009,000	62,610,000
Army Ordnance Department	49,017,897	54,692,680
Navy Bureau of Ordnance	59,672,904	55,165,650
Total	**$472,553,235**	**$452,316,015**

Aeronautical research has never been crowded more relentlessly by the breathtaking pace of developments in the military aircraft field. Designers and military officers now are literally standing next to wind tunnels and test laboratories eagerly awaiting new results to be rushed to the drafting table and the flying field.

The "phasing" of projects has become so unrealistic as thoroughly to frustrate planning and budget offices. Programs long in deliberation, are superseded almost upon issuance by rapid turns in development trends that demand utter reorientation of approach.

All of this is a direct product of, and a great tribute to, the productivity of aeronautical research in the five years since the end of the war.

▶ **Past Catches Up**—"As we look back now at the things we thought incredible five years ago, it seems incredible," says one leading aeronautical research scientist. "We now count heavily on many absolutely known facts that were far less than rational speculation five years ago, and we are now speculating much more convincingly about the next five years."

Here are the blunt, scientific facts of aeronautical research in 1950:

• **Airframes**—We now know how to build them to go as fast as desired.

• **Power**—We now know how to produce as much as is desired for the propulsion of aircraft.

• **Missiles**—We now know how to make them go so high as never to return.

▶ **No Barrier**—The crowning achievement of aeronautical research in the postwar years has been its utter dissolution of the "sonic barrier." This conquest was signaled by the first flight of a man-carrying airplane at a speed faster than sound, it has been manifest by a growing list of such flights of a frequency that permitted the Air Force to state publicly: "We now fly faster than sound every day."

It is because this "barrier" has been "smashed" that aeronautical science is now in touch with infinity. Five years ago an aura of futility surrounded the aircraft design and development profession in its study of sonic difficulties.

▶ **Ahead of Schedule**—Yet, the chronological facts show that the breach of the sonic barrier was accomplished in a shorter space of time than would have been required for a mere orderly progression of aircraft performance at a rate established by its past.

For example, on the basis of several studies of aircraft performance trends, we should only be attaining about 600 miles per hour this year. We would not be due to reach 1000 mph. until about 1985, according to these estimates, which assume no sonic barrier and conventional propulsion means. Instead of this, man flew at 1000 mph. in 1947—38 years ahead of schedule.

The lesson in this situation is this: aeronautical research lies at the root of aviation progress. Research saved 38 years of effort in our assault on the sonic barrier. Research put the operating speeds of current fighters 12 years ahead of their time. Research has opened an infinite vista of technical progress for the aeronautical engineer.

▶ **Price of Performance**—Because of this remarkable progress, research finds itself sorely harassed. Engineers were perfectly content to wait while research fought its battle with the sonic barrier. But the battle having been won, the engineer has moved quickly to the frontier of research, demanding a fast and inexhaustible flow of data.

Never before have wind tunnels whirled so steadily, computers transcribed figures so hurriedly, or research personnel worked so late and so long. The design engineer is snapping at the heels of the research engineer.

The scientist has told the engineer: "There is now no limit to aircraft performance." So the engineer asks: "Then tell me how I can obtain the performance I require."

It is not enough to know that an interceptor can now be built capable of a speed five times that of sound. This knowledge must be expressed in the form of profile ordinates, pitching moment curves and stability derivatives. These data must be provided not for one airfoil, or wing or configuration but for an infinite variety from which the engineer may choose. That is the major current task confronting aeronautical research.

▶ **Fruits of Research**—There are now nearly a dozen U. S. planes capable of exceeding Mach 1.0 in level flight. Another half-dozen are now under construction. These are the tangible fruits of U. S. aeronautical research progress in the past five years.

Yet all of these are based on data now obsolete, information that was exciting news five years ago but now hopelessly out of date. The services are demanding higher and higher performance as they move rapidly toward the supersonic air force long envisioned. The designers are urging research for more speed, virtuosity and productivity to meet these demands.

Yet science always counsels caution because it alone knows that all data are approximate, all figures averages and all machines fallible. The engineer says: "I would rather have a doubtful figure today than a sure one tomorrow." The scientists says: "These data cannot be trusted until more checking has been done." It is this difference in approach that is responsible for much of the impatience between these two vital members of the team.

▶ **Remaining Problem**—There is one aeronautical research problem which does not appear in the three statements above. And this will occupy a prominent role in aeronautical research for many years to come: we do not yet

know how to accomplish these three things economically.

The one statement that cannot be made is we now know how to make an aircraft fly as long and as far as desired. On the contrary, we do not even have enough information to make an aircraft fly at supersonic speed for more than a few minutes.

Until aeronautical research has provided a means by which an aircraft can fly at a high supersonic speed at extremely high altitude for periods measured in hours, it cannot be said to have exploited its capabilities. Many scientists are of the opinion that successful use of atomic energy for the propulsion of aircraft will enable us to vault this last hurdle. A broad government research program is well under way on that problem.

► **The Test**—The test of the efficacy of aeronautical research is the performance of the test article. On this score U. S. aeronautical research far outranks the rest of the world. A U. S. airplane has already flown at Mach 1.5 scores of times. Now flying is a U. S. airplane capable of reaching Mach 2.5 and a third is now nearing completion capable of attaining Mach 3.5.

A U. S. missile has attained a speed of Mach 7.5 and an altitude of well over one million feet. A U. S. turbojet engine has delivered 10,000 pounds of thrust and a U. S. turboprop engine has delivered 10,000 hp.

These are good, solid accomplishments of actual performance that no amount of criticism of our system and methods can explain away. And they have all been accomplished in the brief span of just five years, during which these projects have been taken from nebulous theories in the research laboratory through the painful maze of research processing, design, construction and development, to the ultimate proving ground of actual test.

Engine Definitions

Here are definitions of the major propulsive systems as used by research men:

• **Gas Turbine**—Any of a family of powerplants which utilize a turbine to take energy from a stream of hot gases for doing useful work external from the machine itself.

• **Turbojet**—Air is drawn in the compressor inlet, compressed to a high pressure, passes through a combustion chamber, where fuel is added and burned and the high temperature products expand through the turbine that drives the compressor and continues to expand through a nozzle as a jet in the atmosphere.

• **Turboprop**—A turbojet engine in which the turbine is geared to drive a propeller. When a portion of the hot gases is ejected through a nozzle, the unit is frequently referred to as a propjet.

• **Compound Engine**—A conventional reciprocating engine to which a steady flow exhaust gas turbine and an auxiliary supercharger are added. The engine exhaust gas is ducted to the turbine which is provided with a nozzle for jet propulsion. The turbine drives the auxiliary supercharger and the excess turbine power is delivered to the engine shaft through gearing. An intercooler is provided for cooling the engine charge air after the auxiliary compressor.

• **Turbonamjet**—A conventional turbojet engine with provisions for reheating the gas between the turbine discharge and the exhaust nozzle. Actually a form of constant thrust augmentation, this combination system makes it possible to obtain higher temperatures in the exhaust jet than can be withstood by the turbine.

No Atomic Plane

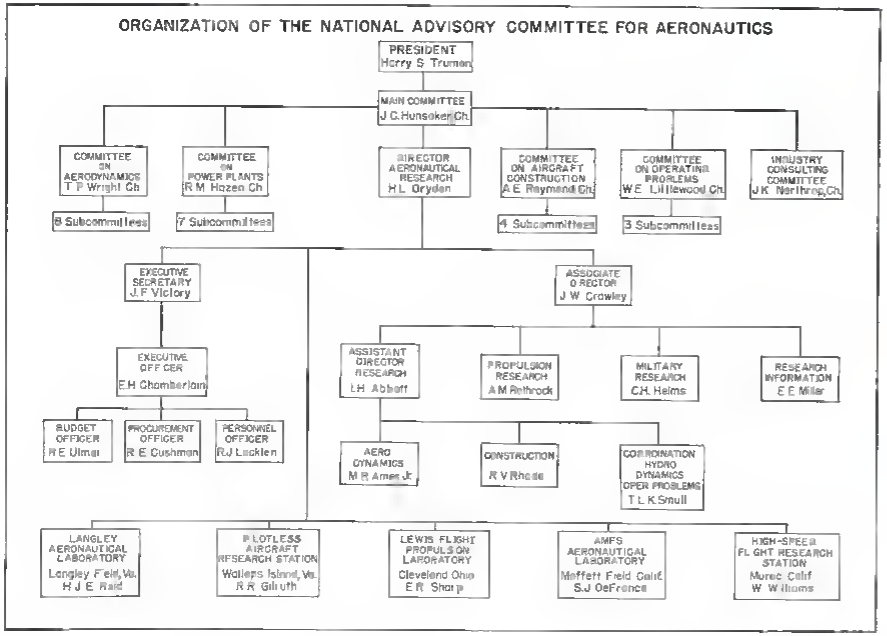
While American atomic scientists are plunging into the job of building a hydrogen bomb, the Atomic Energy Commission has no design for an atom-powered plane and nothing near the construction stage in the field of aircraft reactors.

AEC general manager Carroll L. Wilson admitted to a press conference, in connection with the release of the AEC's semiannual report, that the aircraft reactor is "way back," compared with atomic engines for ships and other types of reactors.

Report disclosed reorganization of the program for developing aircraft nuclear propulsion, but Wilson emphasized it was purely on the management side and no indication of technical progress. Under the new setup four groups will conduct a cooperative program of research: AEC, U. S. Air Force, National Advisory Committee for Aeronautics and the Navy's Bureau of Aeronautics. Technical directors of the laboratories of these groups form a committee which will direct the program.

The new program follows recommendations of the Ad Hoc Committee for Aircraft Nuclear Propulsion and the Lexington Report, prepared in 1948 by the Massachusetts Institute of Technology.

AEC's aircraft reactor studies are being conducted at the Oak Ridge National Laboratory in Tennessee.



How Research Is Coordinated

Free interchange of personnel among various agencies permits full concentration on air power requirements.

Aeronautical research in the U S is a vast, sprawling empire of test equipment, neatly typed reports and planning committees coordinated more by men than by agencies Keynote is informality its watchword is action Many scientists sit on committees which take orders from other committees on which they also sit One day the scientist is voting for a measure that he will receive the next day as an order One day he is rapping for order as a chairman, the next day he is seated two chairs back from the table as an alternate or advisor

▶**Lesson Learned**—It is this interfusion of personnel that gives research the vital cross-fertilization that is its life's blood The Nazis learned too late that compartmentalization of research is fatal, and excessive secrecy its disease The U S has learned this lesson well and has repeatedly vetoed plans for elaborate organizational structures in research that demoralize

The tangible thread that interlaces this informality into a pattern is the requirements of national defense, which at all times, take precedence over other considerations Since authority is inseparable from control of funds in our system, and since the military provide more than 99 percent of the market for research results, it is the National Military Establishment that exercises administrative control over the national aeronautical research effort Its officers sit on every committee, its engineers examine every figure and its executives make most of the decisions throughout the U S aeronautical scene

At the pinnacle of command is the Secretary of Defense whose decisions shape much of the speed and direction of the national aeronautical research program Assisting him are the Joint Chiefs of Staff which determines strategic requirements, and the Research and Development Board which advises him on the technical feasibility of such requirements Both are responsible directly to the Secretary and bear no authority towards each other Coordinating these two functions, however, is the Weapons Systems Evaluation Group, responsible jointly to the JCS and the RDB It is this group which informs the JCS of what is possible, on the basis of RDB study, and which informs the RDB of what is desired, on the basis of JCS study

▶**Problems to RDB**—After this interplay of function has developed a desired weapons system, the problem is turned over to the RDB for the planning and programming of the required research and development RDB breaks down the problem into specific research projects allocated to that branch of the service most vitally concerned and/or best equipped to deal with it

The Air Force has made a major change in its organizational structure to handle those research and development projects assigned to it by the RDB The Office of the Deputy Chief of Staff, Research and Development, has been created, bringing this function to the same staff level as operations, materiel, personnel and the comptroller A new Research and Development Command has been created on the same level as the Strategic Air Command, Continen-

CYLINDRICAL ACCUMULATOR DEVELOPMENT

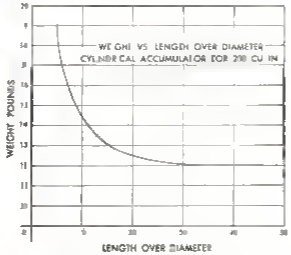
Recent advancements in 3000 psi hydraulic systems have resulted in compact hydraulic systems of low capacity handling extremely high horse power 3000 psi accumulators under development and manufacture for the past 7 years have not as yet been able to meet all requirements of USAF and USN specifications for these devices. Up to now service troubles have been negligible but the more severe operating conditions have caused an out-cropping of accumulator troubles in these particular airplanes.

Approximately a year ago the Pacific Division of Bendix Aviation Corporation, faced with the necessity of overcoming this problem, turned to the cylindrical type of accumulator which was abandoned early in the war. A thorough, concentrated development program carried on during the past year has filtered out the difficulties associated with the earlier cylindrical accumulators with the result that they now have available cylindrical accumulators which have met all requirements of specification AN A-8.

PRICE AND WEIGHT ADVANTAGE

Not only do these accumulators satisfactorily pass all prescribed tests but they meet the weights of the spherical accumulators and are available at a cost considerably below that of the spherical type. Most interesting single phase of the development program is the physical shape of the accumulator. The use of a greater length/diameter ratio has resulted in a minimum of lost weight in the cylinder ends and pistons and at the same time has eliminated problems associated with breathing and allied sealing ring problems.

Pictured below is a chart which shows the weight for a given displacement accumulator as designed with various length diameter ratios.



Also of interest is the fact that where numerous accumulators are required in one airplane, steps can be built into the cylinder to limit the travel of the piston. Requirements for hydraulic systems call for adequate reservoir capacity to permit normal function ing if the accumulators lose their precharge. Large accumulator capacity, therefore, calls for high reservoir capacity but a simple stop in the accumulator to limit the piston travel will save an equivalent volume of oil thus representing an additional weight saving. The small diameter has resulted in exceptional gunfire characteristics. The use of the same specification steel and same heat treatment used on Bendix Pacific spherical accumulators, of which more than 70,000 have been built, has simplified this development problem.

LOST AIR CHARGE ELIMINATED

New style restrained shear rings in the end cap have further contributed to the light weight of the accumulator. The floating piston and seal arrangement designed by Bendix-Pacific has resulted in a minimum chance of lost air charge. In all tests to date only one case of air loss has been experienced and that was directly traceable to a faulty "O" ring. This air loss occurred only at the 0 to 3000 psi cycling test and despite the improper "O" ring no loss of air was experienced at normal operating ranges.

Anticipating an immediate demand for this type of accumulator, the Pacific Division is taking steps to set up high volume production machinery thus contributing to the low price of the cylindrical accumulators.

(ADVERTISEMENT)

tal Air Command, and Air Materiel Command. A new Directorate of Research and Development has been established responsible directly to the Deputy Chief of Staff, Research and Development.

Maj. Gen. Gordon P. Saville, former USAF director of requirements, is named deputy chief of staff, Research and Development, and Maj. Gen. David M. Schlatter, former senior USAF member of the Military Liaison Committee to the Atomic Energy Commission is commanding general of Research and Development Command.

▶**Advisory Board**—The new staff section will exercise overall staff direction for the Department of the Air Force in support of various activities primarily engaged in research and development of new weapons, weapons systems and techniques.

In addition to this staff function the Chief of Staff of the Air Force is also assisted in his decisions by the Scientific Advisory Board, which studies scientific research problems affecting the future development of aircraft weapons and equipment and evaluates long-range plans for research and development. It is the Chief of Staff's check on the efficiency of his staff research and development program as well as a source of new ideas for programs.

▶**Navy Research**—Navy Department has both civilian and military coordination of research projects assigned it by the RDB. Research and development within the Bureau of Aeronautics is directed at the assistant chief staff level by the Assistant Chief of the Bureau of Aeronautics for Research and Development. Chief of the Bureau acts as a Naval Technical Assistant to the Chief of Naval Operations, who is, in turn, principal naval advisor to the Secretary of the Navy.

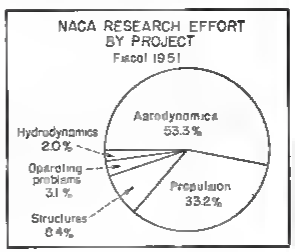
The Secretary is assisted in his study of aeronautical research problems by the Office of Naval Research, responsible directly to him for advice on all research matters. Research programs developed by the Bureau of Aeronautics in conformity with RDB programming are coordinated and approved by the Office of Naval Research to insure coordination with the overall research program of the Navy Department.

Separate from these agencies administratively, but interwoven with them in activity, is the National Advisory Committee for Aeronautics, which reports directly to the President of the United States and receives its funds directly from the Congress. NACA is charged with the responsibility of coordinating the research needs of aviation, preventing duplication in aeronautical research and conducting research on problems either submitted by the armed services or instituted by its own appraisal of the need. The NACA has the most elaborate and advanced aeronautical research facilities in the entire world, together with top-level aeronautical research scientists to conduct the programs and evaluate the results.

The administration of aeronautical research, therefore, is carried out jointly by the Research and Development Board of the National Military Establishment, the Air Force Deputy Chief of Staff, Research and Development, the Air Force Scientific Advisory Board, the Assistant Chief of the Navy Bureau of Aeronautics for Research and Development, the Office of Naval Research and the National Advisory Committee for Aeronautics. The evident complexity of these diverse groups is immediately resolved by the fact that Air Force and Naval officers and civilians make up the membership of these groups and in most cases the same individual serves on two or more of the committees which comprise these various panels.

▶**Who Are Members?**—Members of the various committees of the RDB are drawn from all segments of the government and industry with at least one Air Force, one Navy, one Army, one Department of Commerce and one civilian appointed to each of its major committees. NACA is a prime example of this integration through the membership of two Air Force, two Navy, two Department of Commerce, the Chairman of the RDB and civilians selected from the airframe, aircraft engine and airline industries. NACA scientists serve on a wide variety of committees and subcommittees of the RDB and numerous members of RDB subcommittees are also members of various NACA subcommittees.

It is this interlacing of purposes and ideas through cross membership on committees and boards that provides the essential integrity of the U. S. aeronautical research program. This informal system of assembling the administrative and technical research talent of the nation in infinite combinations comprises the most effective possible method for providing checks and balances in an enormously complex activity.



U. S. High Speed Research Airplanes

Manufacturer	Designation	Engine	Span	Length	Height	Gross Weight	Max. Design Speed
Bell	X-1	Reaction Motors rocket, 6000 lb. thrust. Pressure fuel system.	28'	31'	10' 10"	13,069	1000 mph. @ 60,000 ft.
Bell	X-1A	Reaction Motors rocket, 6000 lb. thrust. Turbine fuel system.	28'	31'	10' 10"	13,400	1700 mph. @ 80,000 ft.
Bell	X-2	Curtiss Propeller rocket.	Swept wing, stainless steel				2250 mph. @ 100,000 ft.
Douglas	X-3	Ramjet, rocket	Under construction, joint U.S.A.F.-Navy Project.				2599 mph. @ 200/300,000 ft.
Northrop	X-4	(2) Westinghouse 19XB2B, 1600 lb. thrust each.	25'	20'	15'	7000	650 mph. @ 10,000 ft.
Bell	X-5		Variable sweep angle wings.				
Douglas	D-558-I	Allison J-35, 5000 lb. thrust	25'	25'	12'	10,000	650 mph. @ sea level
Douglas	D-558-II	Westinghouse 24C, 3000 lb. thrust, and Reaction Motors rocket, 6000 lb. thrust.	25'	45' 3"	11' 6"	16,000	1820 mph. @ 75,000 ft.

Douglas D-558 I

Bell X 1

Northrop X-4

Douglas D 558-II

Air Problems of Research

Administration now well organized, duplication nearly eliminated, but sufficient money still major worry.

Administration of the national aeronautical research and development program is now well-organized and closely integrated with the national defense requirements, on the one hand, and the availability of equipments and staffs, on the other.

All of the loose reins, as exemplified by the veritable deluge of uncoordinated and diverse "research contracts" let during the immediate postwar years, have now been gathered in. Thousands of such contracts have been cancelled and others combined and duplication of effort, except in a few selected areas in which it is desirable, has now been virtually eliminated.

► **Effective Setup**—The present arrangement of administration has proved itself wholly effective and economical in its operation during the past 2½ years. The deficiency in capable research administration personnel (as distinct from research personnel), which severely hampered effective organization, has now been generally relieved and respect and confidence now pervades the entire program. Still not solved is the budget problem in which monies for a project must be determined about two years in advance. Pressure for economy also tends to cancel long-range programs in favor of those having immediate promise, with the result that research, essentially a long-range activity, cannot be wholly exploited.

► **Programming**—It is in the planning and programming of the national research and development effort that the most effective progress has been made since VJ Day. Much of this was futile until the Roles and Missions problems of the services were resolved.

Following agreement on this basic question, the next big problem was decision by the Joint Chiefs and Staff as to the nature of the war that must be planned for. Agreement was obtained on this problem in its broad outline and research and development programs then became more realistic. Integration of Air Force and Naval Aviation requirements then followed and proved so successful that common research and development programs are now being pursued in most of the broad fields of concern to tactical aviation.

But one of the most important results of this programming function has been formulation of virtually a national guided missiles program with resulting economies in cost and concentration of effort. Today, any selected test chosen at random can be shown to be part of a detailed program developed and sanctioned by joint Air Force-Naval civil aeronautical research committees.

► **Tactical Aircraft**—The Air Force has definitely programmed a supersonic interceptor force, a transonic penetration fighter force and a transonic heavy bomber force for 1954-5. Prototypes of these force have already been flown or are scheduled during 1950-1. Following a long delay in prototype authorization while research and development results were being analyzed, the Air Force is now activating bids for new aircraft in these various categories.

Production plans for current prototypes will be held to quantities sufficient to provide service tests and a nucleus of combat forces, but substantial production will not be entered into until the outcome of the new prototype program is in sight. Heavy accent is being placed on "all weather" electronic equipment development, which is planned as standard installation in all combat aircraft regardless of type. So vital is this latter program regarded that airframe is rapidly assuming a secondary importance in aircraft planning.

► **Wait and See**—Navy has not yet felt justified in programming supersonic fighters until the low speed end of the speed range becomes much more clear. The problem of operating supersonic fighters from carrier decks is enormous and Navy has adopted a "wait-and-see" attitude in its planning for fighters. Meanwhile, it is concentrating development on existing types to lift them into the transonic speed regime and very satisfactory indications are already in hand.

Cancellation of the super-carrier was a severe blow to Navy aircraft planning and one of such magnitude as virtually to disorganize their programming. Navy had elaborate plans for multi-engine attack aircraft with supersonic maximum speed and transonic cruising speed. Such aircraft absolutely require a carrier the size and capacity of the projected 65 000-ton "United States." Its cancellation has resulted in compromises to the attack aircraft requirements and bid invitations have just been issued on the new requirements.

Extremely high altitude has become a basic requirement for Navy interceptor aircraft and this requirement is integral with that of low speed stability and control necessary for carrier operation so that it is obtained more easily in a Naval aircraft than in an Air Force design. Like the Air Force, Navy is placing major emphasis on "all-weather" electronic equipment for its future aircraft, although its operational requirements still demand major emphasis on airframe design and development.

► **Propulsion**—Both Air Force and Navy planners are working wholly in terms of 10,000 lb. thrust for turboramjet engines and 10,000 hp. for turboprop engines. Prototype engines meeting these requirements are already running and flight test installations being made. Air Force has received major cognizance of turbojet engine planning and its future programming is for 20,000 lb. thrust.

Navy has received major cognizance for turboprop planning and is studying requirements for 12,000 hp. units, already in sight. Both services are concentrating on high altitude and low specific fuel consumption through relaxation of engine weight requirements. This latter permits the use of very high pressure ratios (20 or more) through very large numbers of compressor stages at a substantial penalty in engine weight.

► **Missiles**—Air Force will test missiles this year with 5000-mile ranges. Two types are now in initial production. Both are supersonic maximum-transonic cruise designs powered by conventional Allison J-33 turbojet engine.

At this stage Air Force has no clear idea how these missiles will be guided into their targets although a variety of workable systems are now being pressed. Most promising uses automatic celestial navigation but the detailed problems are enormous. Initial guidance will use ordinary low-frequency radio but elaborate systems of air-to-air control using very high and ultra-high-frequency have been developed.

Surface-to-air missiles are now well in hand and the airframe and propulsion problems are now substantially solved. Remaining are stability and control and target-seeking equipment. Stability and control theory is well developed and mechanical difficulties are all that remain.

Homing remains a major problem however insofar as range is concerned. Close range homing is now well-developed and when methods for placing the method in proximity to the target are assured, then SAM type development will proceed rapidly.

Air-to-air missiles are no longer a problem and a wide variety are now under test. Several of these are ready for large quantity production when required. Stability and control problems in AAM are minimized by the short duration of the flight. Rocket powered and proximity fuse-armed these small missiles have completely replaced machine-gun and cannon as fighter armament in future planning.

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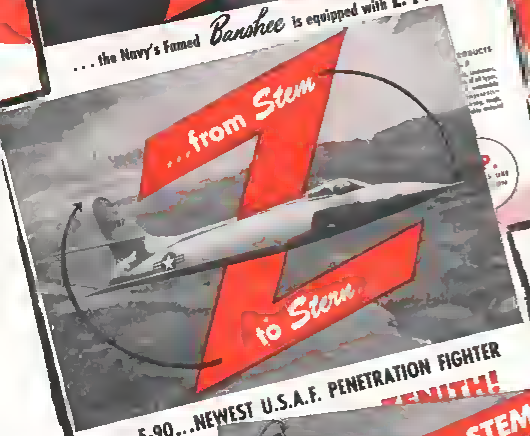
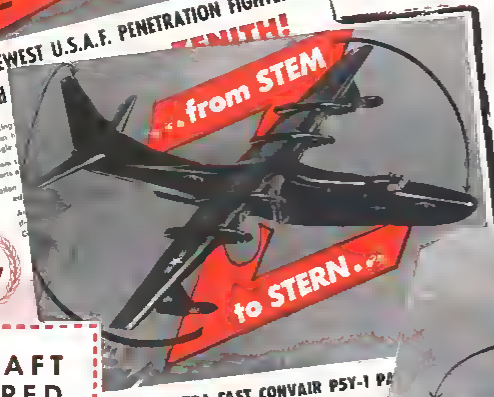
(*LOW PRESSURE LAMINATION)

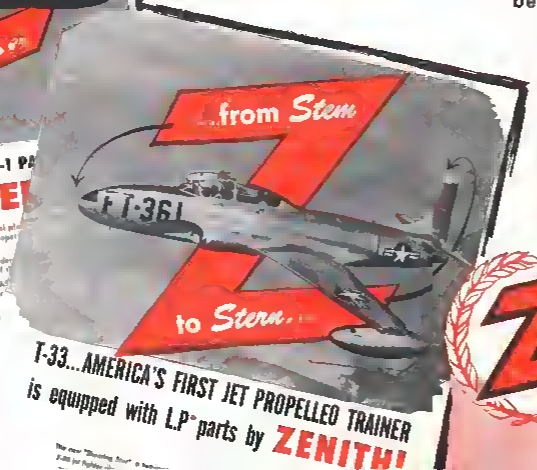
...the Navy's Famed *Banshee* is equipped with L. P.* Parts



....F-90...NEWEST U.S.A.F. PENETRATION FIGHTER is equipped



NAVY'S ULTRA-FAST CONVAIR P5Y-1 PA
equipped with L. P.* parts by ZE



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Copters Proving Usefulness to Air Power

Military recognition of rotorcraft as other than rescue vehicle sparks civil plans.

The two-year period of 1949-1950 may well be regarded as a major turning point for the helicopter industry. After several postwar years of striving for recognition of the copter's utility and demonstrating its abilities, the helicopter industry during the past year has seen substantial military requirements crystallize and promising commercial helicopter transport plans develop.

Earlier inertia in official copter thinking was in large part a result of rescue accomplishments by copters so dramatic that, until recently, they diverted the perspective of military planners from the numerous other basic functions that the copter is peculiarly suited to perform. Even in the rescue field, only a small start had been made as compared to current copter plans. But the past year has seen a simultaneous blossoming of serious helicopter interest and substantial copter requirements in all of the services.

▶**Market Expansion**—The helicopter market unquestionably has expanded more than in any previous year. This growth may not be fully reflected in deliveries until 1951, but even on the basis of only those new requirements that have developed to date, increased production is a certainty.

Advent of this enlarged helicopter market has been stimulated by corresponding growth in the size of helicopters. During the past year the transport helicopter (i.e., capable of carrying ten or more passengers) has come into its own to such an extent that today most of the major rotary wing manufacturers have machines of that size flying and in production to fill existing orders. A large part of rotary wing activity user requirements as well is producer effort has jumped from the 2- to 4-place machines of prior years to the transport helicopters which are a flying reality today.

Until 1949, Piasecki was the only manufacturer producing large helicopters. (Kellett and McDonnell each had built one prototype of transport size, but no production articles.) Bell with its H-12 and Sikorsky with its S-55 now have entered the large-helicopter field and both companies already have military orders for their transport-size copters. At the same time, Piasecki has entered into production of the HRP-2, an advanced version of its familiar big tandem rotor helicopter.

▶**Military Reflection**—This industry-wide activity in building larger helicopters is a direct reflection of firm military requirements for copters to carry bigger loads over greater distances. The most immediate order for these large copters will be the largest peacetime order that has ever gone to the helicopter industry—an Air Force procurement of twenty or more so-called Arctic Rescue copters at a cost that may be as much as $12 million.

Air Force specifications require a machine that will fly 250 miles, hover 30 minutes at the 250-mile destination, perform the rescue, and return 250 miles to base. This is performance beyond the capabilities of smaller helicopters, but it should be within reach of the machines that have been demonstrated throughout the industry in the past year. Moreover, the Arctic Rescue procurement is not a design competition, but a prototype competition with only those machines that were flying realities in November 1949 being eligible.

The Air Force is not alone in its requirements for big copters. The Marine Corps in 1949 adopted the transport helicopter as a basic vehicle for assault landing of troops, weapons and supplies. In May, 1949 before about 60 Congressmen and Senators the Marines put on a convincing demonstration of the ability of large copters to place troops and equipment at the scene of combat far more speedily and with less exposure to enemy action than via amphibious landing craft, parachute or glider. The Marines definitely want big copters in numbers. The size of the Marine market probably depends only on the relative position of the Marine Corps in the Defense program.

▶**Navy Requirements**—The Navy anti-submarine warfare program calls for large copters, too. Navy has been conducting development work with the helicopter as an anti-sub vehicle for several months. Suitability of the copter's specialized flight characteristics to ASW has been clear for some time, operational use of copters to hunt and fight subs has awaited only machines with sufficient range to carry on the search and sufficient load carrying ability to haul ASW search equipment and weapons. Copter procurement for ASW is expected soon, now that the large copters are here.

Air Force, Marine Corps, and Navy requirements all focus on machines of the same general size. Exchange some gas load for more troop capacity, and the Arctic Rescue copter becomes a potential Marine assault transport. The service needs are here, the large copters are here, and the combination makes for a healthy production outlook.

Military requirements for smaller helicopters have been expanded and put on a more solid basis during the past year. Navy is replacing all of its seaplanes on battleships and cruisers with helicopters. The current Piasecki HUP procurement is destined for this mission. Marine Corps is converting its liaison squadrons from fixed wing to helicopter, a complete changeover. The Marine Corps order will call for machines with considerably greater performance than the small copters in military use today.

▶**Navy Orders**—BuAer procurement competition to equip the Marines' liaison squadrons with helicopters probably will bring as much competitive activity and as many new or improved helicopters in the 3-place field as the Arctic Rescue competition has brought in the transport category. This is likely because the first BuAer order (14 helicopters) probably will be followed by more. Also the copters picked for the Marines will be eyed with considerable interest by the Army and the Coast Guard in their copter buying.

BuAer procurement specifications for the Marine Corps craft illustrate the close similarity between commercial and military copters. Even though it's not an off-the-shelf purchase, a copter can qualify by getting a CAA certificate in lieu of meeting military handbook specifications. This is wise procurement policy for two reasons. The helicopter is a vehicle, not a weapon, and the military vehicle is identical with its commercial counterpart except for specialized extra equipment such as hoist and litters. Moreover, the civil airworthiness standards for copters probably do a bet-

ter job of defining an acceptable helicopter than do military handbooks and specifications which are designed primarily for fixed wing aircraft.

This close similarity between commercial and military copters is a potent impetus to lively competition on military orders, for the military choice also gets a foot in the commercial door.

► **Market**—Commercial market for small copters showed little improvement in the past year, even with the entrance of Kaman and Hiller into this field and the addition of their sales efforts to a market that previously was being developed by Bell alone. Combined commercial sales of Bell, Kaman, and Hiller in 1949 probably did not exceed the '47 or '48 commercial sales of Bell alone. The lag was in sales to general charter operators and to agricultural operators.

Even with competitive price reductions that ran three manufacturers selling in the $20,000-$23,500 bracket, agricultural sales were not sufficient to permit production lines to operate continuously. However, the number of agricultural and general charter operators did increase slightly, and the year's implication is that of a leveling-off rather than decline in the charter copter field.

While agricultural sales have lagged, two promising new fields for smaller helicopters have shown healthy growth over the past year. The copter is finding itself increasingly useful in mineral and petroleum exploration and survey. With the advent of lightweight geophysical equipment that permits all necessary apparatus to be helicopter-borne, the copter is finding a ready place in the survey of mountain, jungle, arctic, and swampy resource bearing areas. It's ability to land at inaccessible, unprepared sites and to provide speedy access over intervening rugged areas has increased geophysical survey production by as much as 300 percent in areas of difficult terrain. At last count, ten copters were engaged full time in oil surveys in the marshlands of Louisiana alone, with a number of copters being applied to this work abroad as well as in other domestic areas.

► **Mapping Service**—The same features which make the helicopter useful in geophysical work make it an excellent vehicle for mapping of difficult terrain. Copter use in this field has grown considerably in the past year. The U. S. Geological Survey, the Coast and Geodetic Survey, and the Army Map Service all used commercial helicopters under contract for mapping in Alaska.

Mapping contracts are short-term and in themselves don't constitute much of a market for copters. But this type of work does serve to diversify the charter operator's field, round out his seasonal variations, and thereby make the charter operating market healthier.

Scheduled commercial helicopter operations got a big boost in August, 1949, with the inauguration of copter mail service in the Chicago Metropolitan Area over the routes of Helicopter Air Service, Inc. Within three months, HAS had all of its routes activated, with regular flights to the roof of the downtown Chicago Post Office and to ground heliports in 43 suburban communities. Completing 94 percent of its scheduled flights, HAS carried over 700,000 lb. of mail (over 30 million letters) in its first five months of operation. Meanwhile the mail copters of Los Angeles Airways, now in their third year of regular service, carried record loads of over 4 million lb. of mail in 1949.

► **N. Y. Copter Service**—Success of the Los Angeles and Chicago copter mail services and the advent of large transport copters have combined to generate promising proposals for helicopter mail and passenger service for the New York metropolitan area. Using the ten-place or larger machines whose availability has been accelerated by the military copter program, strong cases for the certification of such service have been presented in CAB hearings. The proposed routes would provide speedy transit of passengers and mail between New York's airports and downtown Manhattan, between the airports and suburban communities within a 50 mile radius, and inter-airport service to speed transfer of mail and passengers from one flight to another.

Interest in a copter transportation system for the congested, waterway-slashed New York area is not confined to would-be operators and copter manufacturers alone. The hearings saw the Port of New York Authority, the City of New York, the states of New York, New Jersey, and Connecticut, and other municipal and civil groups vigorously support the need for the rapid transportation that the copter is uniquely qualified to render. In recent strong letters to the CAB, the Departments of Defense, Army, Navy and Air Force have urged establishment of a copter transport network in New York. Their position is summarized in a sentence from the Air Force communique which states, " . . . the increased facilities made available by the employment of helicopter air transport in large cities would most certainly increase the defense potential."

► **Set Pattern**—The Los Angeles and Chicago copter mail lines are watching the New York case with anxious interest, as are copter applicants in other big cities. For it is expected that the New York case will set the pattern for establishment of copter passenger and mail service in other metropolitan areas.

where surface transportation has reached its limits. Certification in New York well may mean early extension of the Los Angeles and Chicago services to carry passengers as well as mail. Conversely, denial of service to New York may temporarily close the door to certification of helicopter service in other areas. But this would be only an interim set back to helicopter transport plans, for the time savings inherent to copter service in congested areas make certification of additional services inevitable.

Apart from the future implications of the New York case, certification in New York alone will mean a sizeable order for copters. It would be the largest single order ever to come from a commercial customer and one approaching most military orders in dollar value.

After the lethargic helicopter market that prevailed until recently and the existence of few helicopter types capable of carrying large loads, the simultaneous upturn in military requirements, the promise of major commercial transport services, and the introduction of 10-place and larger machines by all major copter manufacturers may appear too sudden to be realistic.

► **Progress**—However, it must be realized that the rapid progress achieved in the helicopter field—progress in helicopter size and performance, operational techniques, and user interest—is in large part a product of the times, the era of healthy technical environment in which the copter has developed.

Unlike the automobile and the airplane, which had to await general technical progress essential to their own advancement, the helicopter is maturing in an age of technology when all the necessary skills, scientific data, materials and processes are readily available.

The only thing relatively new about the helicopter is the practical application of the rotary wing principle of flight which it utilizes. Copter design, construction, and operation are not hamstrung by inadequacies in metallurgy, engines, aerodynamic data, and other technology that was not so fully developed at this stage of the lives of other new vehicles. This healthy technical atmosphere provides fertile environment for rapid growth of the copter and its utility.

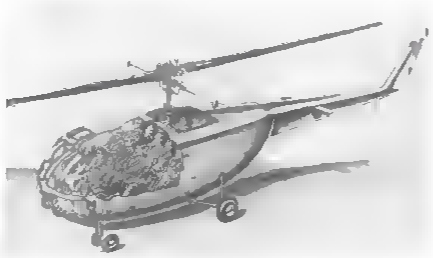
Copter Pilots

New York has 108 helicopter pilots, largest number in the nation, according to a statewide survey by the Civil Aeronautics Administration.

Total number of helicopter pilots in the country is 659, and California is second with 72.

Among U. S. Helicopters . . .

Piasecki HRP 1 Rescuer



Bell Feederliner

Piasecki HRP-2

Piasecki HUP-1

Sikorsky H-5H (HO3S) (S-51)

Sikorsky S-52 (H-18A)

Bell XH-15

Sikorsky H-19 (S-55)

Leading Helicopters of the U.S.

Manufacturer	Designation	No. of places	POWER PLANT: No. of engines, make and model no.	Takeoff hp.	At rpm.	Fuel cons. cruising (gph)	PERFORMANCE: High speed (mph)	Cruising speed (mph)	S.L. climb at gross weight (fpm)	Hovering ceiling (ft) without ground effect	Absolute ceiling (ft)	Normal range (mi.)	WEIGHTS: Gross weight (lb.)	Empty weight (lb.)	Rotor disk loading	Power loading	MAIN ROTOR: No. of rotors	Blades per rotor	Diameter	Total blade area (sq. ft.)	Rotor rpm., cruising	ANTI-TORQUE ROTOR: No. of blades	Diameter	Total blade area (sq. ft.)	Rotor rpm., cruising	No. built
American Helicopter Co., Inc. Manhattan Beach, Cal.	XA 5	2	1AHC AJ 8 75 pulse jet	70			80*				14,000*		1500	920	1 75	18 6	1	2	33						...	1
Bell Aircraft Corp. Buffalo 5, N. Y.	47D1	3	1 Fr 6V4-178-B32	178	3000	12	92	85	800	8800[1]	11,000	200	2 200	1380	2.3	12 3	1	2	35 1.5"	35 24	333	2	5'8"	2.4	1800	18
	48A (YH-12B)	5-8	1 P&W R 1340-55	600	2250	25	105	90			15 000	300	6 286	4450	3.4	10 5	1	2	47 5	70.96	279	2	8 5	5 25	1406	11
	54 (XH 15)	2	1[2]	275	3200	...							2,700	2000	2.5	10 6	1	2		....	332	2	6.45		1800	3
Doman Helicopters, Inc. Danbury, Conn.	Pelican	...	1 Airc 6AL-500	245	3000	14.2	85	75	1135	3300	14,000	225	3 200	1800	2	13.1	1	4	45'	686	210	3	8'	4 7	1360	...[3]
Gyrodyne Co. of America New York, N. Y.	2	5	1 P&W Wasp Jr B-4	450	2300	27	112	89	1250	2000	22,100	270	5 400	3600	2.98	12	2	2	48	1810	192		...	...	...	1
	5[4]	3	1 Con XO-470-5	274	3200	19	161	155	1200	14700	21,000	264	2,795	2035	2 75	10 2	1	4	36'	1017	312	2	7	38 5	2350	1[5]
	7	12	2 Ly GSO-580	375	3300	60	162	150	780	8800	23 000	250	7 600	4645	3 59	10 1	2	2	52	2120	230					1
Kaman Aircraft Corp. Windsor Locks, Conn.	K-225 (XHK-225)[6]	3	1 Ly O-435	225	3000	13	73	65	1000	4000	12 000	200	2 500	1800	1.97	11.1	2	2	38'	...	236				...	7
Kellett Aircraft Corp. Camden 11, N. J.	KH-2X (XH-10)	12	2 Con R 975-15	525	2450	46	120+	90	1650	4000	20,000+	350	11 000	8256	2 97	10.5	2	3	65	296	140				...	1
McDonnell Aircraft Corp. St. Louis, Mo.	Whirlaway (XHJD-1)	10	2 P&W R 985	450	...		110	90	1300[7]			350	11,000		3	12.3	2	3	50[8]	330						1
	Little Henry	1-2	2 McD ramjets				50+						530+	280	.	...	1	2	18'		640					2
Penn Elastic Co. Phila., Pa.	81	2	1 Fr 335	150	2575	9*	...						1,300	700	2 97	13 3	2	3	29.5'	26.26	320					1
Piasecki Helicopter Corp. Morton, Pa.	PV-3 (HRP-1)	10	1 P&W R-1340	600		30	120	85	800	4800	12,000	300	6,900[9]	5000			2	3	41'							20
	PV-14 (HUP-1)	5	1 Con R 975-34	525	2300	24	130	110	1800	8000	16 800	400	5 355[10]	3956			2	3	35'							3[11]
	(H&P 2)	10	1 P&W R 1340-AN-1	600		30	105	85	800	4500+	11 000	300	6,978[12]	5054			2	3	41'						...	...
	PV-15 (XH-16)																...	...							...	...
Seibel Helicopter Co., Inc. Wichita, Kan.	S-4	2	1 Ly O-235-C1	115	2800	7	78	65	800	10,000	15,000	200	1 450	930	2 2	12 6	1	2	29	22	390	2	5 5'		1525	1
Sikorsky Aircraft Div., United Aircraft Corp. Bridgeport, Conn.	S-51 (H-5 or HO3S-1)	4	1 P&W R 985-B-4	450	2300	28	103	85	1000	5,000	14 600	255	5 500	3805	2 92	11 2	1	3	49'	87 6	196	2	8'8"	6.16	1278	100**
	S-52-2 (H 18A)	3-4	1 Fr 6V6-245-E16F	245	3275	14	118	92	1050	2 800	12 500	415	2,800	1650	3.04	10.6	1	3	33'			2	5'4"	..		1
	S-55 (H-19)	12	1 P&W R-1340	800	2250	35	110	86	1100	3,800	14,600	470	6 800	4200	3 06	11 3	1	3	53		194	2	8 8"		1360	1
United Helicopters, Inc. Palo Alto, Calif.	360	3	1 Fr 6V4-178-B-33	178	3000	12	84	76	625	.....	9,000	200	2,247	1447	2 34	12 6	1	2	35'	32 3	327	2	5.5'	...	1895	35

AHC - American Helicopter Co.
Fr - Franklin
P&W - Pratt & Whitney
Airc - Aircooled Motors
Ly - Lycoming

Con - Continental
McD - McDonnell
** Approximate 1949 output. * Approximate
1 In ground effect
2 1 Continental XO-470-9 or Franklin XO-425-7 engine.

3 Prototype under construction.
4 Convertible aircraft coaxial rotor plus stub wing.
5 Being built.
6 U. S. Navy type.
7 With one engine, climb at sea level is 200 fpm.

8 9 ft. intermesh.
9 Overload gross weight is 8000 lb.
10 Overload gross weight is 5605 lb.
11 22 on order.
12 Overload gross weight is 7267 lb.

Growing Lift Capacity Aiding Air Power

But commercial transport fleet is still far under number needed for war use.

By Charles Adams

U S commercial airlift has been growing at a spectacular rate during the postwar period But like the Air Force itself the airlines still have a long way to go if they are to help provide the military strength which the President s Air Policy Commission two years ago said was necessary for "Survival in the Air Age."

Planes used by U S scheduled domestic and international carriers have more than doubled since the end of 1945 rising from 457 to 1075 at the end of 1949 Seat capacity of the commercial fleet nearly quadrupled in the same period jumping from 10,298 to 38 986

► **Lift Potential**—Most impressive, however has been the airlines' soaring lift potential which takes into account not only the number of planes and their seat capacity but also their speed and range for the long haul (such as the transcontinental run) An AVIATION WEEK survey shows that available lift of the scheduled passenger carrying airlines alone has risen more than sevenfold since the end of 1945

(The survey is based on the estimate that a Constellation or a DC-6 on the long haul can produce close to eight times the lift of a DC 3 a Martin 2-0 2 or Convair liner roughly 3 times as much as a DC 3 etc)

As of December 1949, the U S scheduled domestic and international transport fleet (excluding all cargo carriers) consisted of 452 DC 3s 233 DC-4s, 110 DC 6s 5 Boeing Stratoliners 41 Boeing Stratocruisers 24 Martin 2 0 2s 113 Convair liners 80 Constellations 11 Lockheed Lodestars and 6 Lockheed Electras By contrast, the December 1945 fleet included 406 DC 3s, 13 DC 4s, 2 Douglas DSTS, 8 Stratoliners " Boeing 314 flying boats 18 Lodestars and 3 Electras

► **Growth Continuing**—The airline fleet is still growing TWA for example expects to acquire 26 more Constellations this year United will add five DC 6s and TWA and Eastern are expected to order over 60 new twin engine transports American Airlines has contracted for 11 and UAL for 6 of the larger faster DC 6Bs

If the planes of four scheduled all-cargo carriers and around 80 large non scheduled and contract carriers are added to the 1949 total, the growth of U S commercial aviation during the past four years would loom even greater The four airfreight carriers—Slick The Flying Tigers, U S Airlines and Air news, Inc—are operating a total of 29 C-46s 5 DC 4s and 3 DC-3s The large nonskeds have 67 C-46s, 33 DC 4s

Growth of U. S. Scheduled Transport Fleet*

(Planes and Seats Available)

1949

No	Planes	Seats
452	Douglas DC-1	9,492
233	DC-4	11,650
110	DC 6	5 500
5	Boeing 307	190
41	Stratocruiser	2, 460
24	Martin 2-0-2	960
113	Convair 240	4,520
44	Lockheed L-49	2,200
13	L-649	650
23	L-749	1,150
11	Lodestar	154
6	Electra 10A	60
1,075		38 986

1948

No.	Planes	Seats
478	Douglas DC-3	10,038
246	DC-4	12,300
109	DC-6	5 450
5	Boeing 307	190
24	Martin 2-0-2	960
88	Convair 240	3,520
44	Lockheed L-49	2 200
13	L-649	650
16	L-749	800
12	Lodestar	168
6	Electra 10A	60
6	Beech D-18C	48
1 047		36 384

1947

No	Planes	Seats
513	Douglas DC-3	10 773
264	DC-4	13 200
86	DC-6	4,300
4	Boeing 247 D	10
5	307	190
9	Martin 2-0-2	360
44	Lockheed L-49	2 200
18	L-649	900
12	Lodestar	168
6	Beech D-18C	48
961		32 179

1946

No	Planes	Seats
470	Douglas DC-3	9,870
201	DC-4	10 050
4	Boeing 247-D	40
8	307	280
40	Lockheed L-49	2 000
12	Lodestar	168
1	Beech D-18C	8
736		22,416

1945

No	Planes	Seats
406	Douglas DC-3	8 526
13	DC-4	650
2	DST	42
8	Boeing 307	280
7	314	518
18	Lockheed Lodestar	252
3	Electra 10A	30
457		10,298

1941

No.	Planes	Seats
10	Douglas DC-2	224
255	DC-3	5 379
45	DST	945
28	Boeing 247 D	280
8	307	255
16	Lockheed Lodestar	224
19	Electra 10A	190
6	Sikorsky S-42	192
4	S-43	56
378		7 745

* Certificated Alaskan carriers included Certificated all-cargo carriers (Slick, Flying Tigers, U. S Airlines) excluded

(Figures shown are as of December of each year)

74 DC-3s and 4 miscellaneous transport-type aircraft

Lumping together the regular airline fleet of 1075 planes, the all-cargo fleet of 37 planes and the nonsked fleet of 178 planes gives an overall total of 1290 aircraft. This is still a far cry from the 3000 to 5000 transport-type aircraft that military officials predict will be required in the event of war.

▶ **Mats Strength**—The Military Air Transport Service has 303 planes in its transport fleet, including 151 C-54s, 27 R5DS (Navy equivalent of the C-54), 8 Douglas C-74 Globemasters, 5 C-82 Packets, 6 Boeing C-97 Stratofreighters, 8 C-121 Lockheed Constellations, 1 Douglas C-118 (DC-6), 2 C-46s and 95 C-47s. MATS has other transports used in non-transport service, and other branches of the military have their own transport and troop carrier aircraft.

To date, the government has refused to allot funds for the development of new cargo transports as recommended by the President's Air Policy Commission. In fact, the whole drive for a government-financed prototype program bogged down early this year when the Budget Bureau rejected an Air Force cargoplane development plan.

This has strengthened current airline industry belief that its present reciprocal-engine transports will form the backbone of its fleet for the next five years. Top airline officials believe that jet transports won't handle as much as 25 percent of U. S. commercial air traffic before 1955.

▶ **Mobilization Plans**—While the Air Force has found it necessary to concentrate its available funds on combat-type aircraft, the airline fleet is being watched closely by the military. Two plans for immediate mobilization of the commercial fleet in event of an emergency have been drawn up.

MATS prepared one plan, and the Air Coordinating Committee another. It is understood that the MATS plan contemplates taking over a maximum of the commercial airlift, with special emphasis on four-engine equipment.

The ACC, which has civilian interests represented, would not go as far. However, as a practical matter, it is generally recognized that in the event of a war the military's views of its own requirements would prevail.

▶ **Deficit Seen**—Even though there has been no money forthcoming for commercial prototype development, defense planning officials have manifested concern over the deficit in reserve airlift. Hubert Howard, chairman of the Munitions Board, last month placed the need for additional airlift at the top of the list of defense transportation equipment needs.

Adm. Emory S. Land, Air Transport Assn. president, estimates that if the military were required to maintain a reserve of four-engine planes equal to the number now in use on the scheduled airlines it would first have to spend $300 million on equipment. And if the military kept these planes in operational condition with trained crews ready for a national emergency it would cost $200 million annually.

▶ **Personnel Comparison**—Comparison of 25,000 MATS personnel engaged in air transport operations with the growing personnel of the scheduled airlines is significant. As of last September, the regular domestic airlines (including feeders and territorial carriers but exclusive of all-cargo and nonscheduled operators) had 60,699 employes.

Of this total, 5378 were pilots or copilots, 597 flight engineers, flight communications officers, flight mechanics and navigation officers, and 14,456 mechanics. All of these categories are especially vital to the air reserve.

In addition, U. S. international flag lines on Sept. 30 had 22,129 employes of whom 1670 were pilots or copilots, 1111 were flight engineers, flight communication officers, flight mechanics and navigation officers, and 3771 mechanics.

▶ **Expansion Factors**—Assuming there is no artificial government stimulus, fur

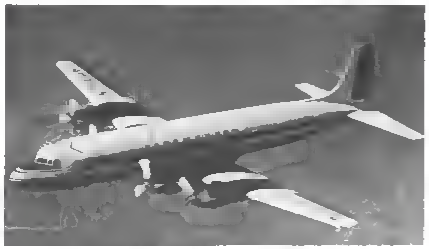
Among U. S. Transport Planes . . .

Consolidated Vultee Convair Liner

Douglas Super DC-3

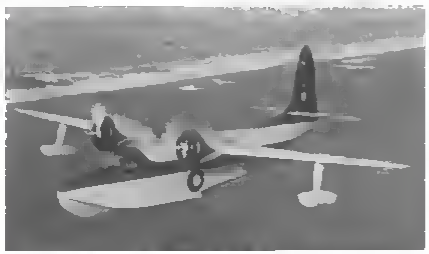
Boeing Stratocruiser

Martin 2-0-2



Douglas DC-6A Liftmaster

Lockheed Constellation



Grumman G-73 Mallard

Beech D-18S

ther expansion of the airline fleet will depend on traffic growth resulting from three major factors increased safety, better dependability and low fares All of these factors contributed importantly toward the carriers' better business during 1949

Safety wise, U S scheduled airlines made their best record in history last year Passenger fatalities on certificated domestic trunklines, feeders and U S international flag lines combined fell to a new low of one per 100 million passenger miles flown Best previous record was 1 3 passenger fatalities per 100 million passenger miles set in 1948

From 1943 through 1949, the industry's passenger fatality rate was below two per 100 million passenger miles flown in four of the seven years In the other three years the passenger fatality rate did not go above 2 7

These rates can be compared with the 23 fatalities per 100 million passenger miles in 1930, 21 4 in 1931, 16 8 in 1932 and 9 5 as late as 1936 and 1937

Government and industry officials hope for steadily improving safety records in the future with the help of better operating methods and more and improved air navigation and landing aids

▶**Dependability Improves**—The airlines have made long strides in dependability during the past few years United Air Lines, for example, completed a record 98 percent of all its scheduled miles in 1949, with 92 5 percent of the flights originating on time or within 15 minutes of schedule Almost 75 percent of UAL's flights arrived at their final destinations within these same time limits The company's on time departures improved nearly 10 percent over 1948, and on time arrivals improved 27 percent

This performance presents a striking contrast with the dreary picture painted by the President's Air Policy Commission in its report of January, 1948. The Commission noted that in June, 1947, a good weather month, one of the major airlines had 89 percent of its planes arriving in New York City late, and 46 percent of all planes were delayed more than an hour In the same month, 41 percent of all plane departures from New York were late, and 16 percent were over an hour late

▶**Fares Lowered**—Average airline fares both domestic and international, turned downward during 1949 after rises during 1947 and 1948 Domestically, the average fare is now only slightly higher than in the immediate pre war period Fares on U S international flag lines are below the 1941 level despite a great increase in the general price index

Barring a depression, Air Transport Assn officials expect a 5 percent annual increase in domestic traffic, compounded over a 15 year period This would mean that the 1948 traffic level will be doubled by 1963, with a good possibility that it may be 2½ times the 1948 level.

▶**Coach Influence**—The forecast takes into account the normal increase in first-class travel by air, continued diversion of first-class traffic from other modes of transportation, and a continued increase in over-all travel It assumes that air coach will create new air travel markets by tapping rail coach and bus business, and assumes increased use of cargo service

(One company now seeking a transcontinental air coach certificate has estimated that if the 1948 domestic fare level of 5 76 cents a mile holds steady, domestic revenue passenger mileage will increase from under 7 billion in 1949 to over 15 billion in 1954 But it predicts that if fares generally drop to the four cents-a-mile coach level the 1954 passenger-mile total would soar to nearly 32 billion)

▶**Congestion Feared**—ATA sees difficulties ahead as business grows The traffic increases will not be spread equally over a 24-hour period This will mean peak hour saturation at many airports

Labor

Run-down on unions active among airline employes.

Unionization of airline employees continues at a fast pace. As the industry grows, the unions get more members from the additional workers and by signing up more of the non-union personnel.

This table of the unions, with which 19 major air carriers had labor contracts last June 30, gives an idea of the extent of labor activity in the industry.

▶ **Growth**—The number of airline labor contracts on file with the National Mediation Board has grown steadily from 4 in 1937 to 224 last June. Most rapid

Carrier	Pilots	Flight engineers	Radio and teletype operators	Flight navigators	Mechanics	Flight dispatchers	Clerical, office, stores, fleet and passenger service	Stewards and stewardesses	Guards-watchmen	Miscellaneous
American	ALPA	ACFEA	ALCEA, ARA		TWUA		TWUA [6]	ALS&SA [12]	IAM	
American Overseas	ALPA	ALFEA	FCOA	AAN	TWUA [5]	ALDA		FP&SA [13]	IAM	TWUA [10, 11]
Braniff	ALPA		ALCEA, ARA		UAW	ALDA	BRC	ALS&SA	UAW	SAM [10]
Capital	ALPA		ALCEA, ARA		IAM	ALDA	BRC	ALS&SA [12]		UTSEA, [8, 10] IAM [20]
Chicago & Southern	ALPA		ACCOA		UAW [1, 10]	ALDA		ALS&SA [12]		
Colonial	ALPA				IAM		IAM	ALS&SA [12]		
Continental	ALPA				UAW [1, 2]	ALDA		ALS&SA [12]	IAM	SAM [11]
Delta	ALPA				UAW					
Eastern	ALPA	ALFEA			IAM [3]			ALS&SA		
Inland	ALPA		ALCEA, ARA		UAW	ALDA	BRC	ALSA [13]		UAW [10]
Mid-Continent	ALPA		ALCEA, ARA		UAW [4]	ALDA	BRC	ALS&SA [12]		UAW; [10] SA [8]
National	ALPA		IAM		IAM	ALDA	IAM	ALS&SA [12]		
Northeast	ALPA		ROU		IAM	ALDA	BRC	ALS&SA [12]		
Northwest	ALPA		ALCEA, ARA	ALNA, TWUA	IAM [1]	ALDA	BRC [21]	ALS&SA	UAW	IBTCHW&H [10] IAM [11, 15] SAM [16]
Pan American	ALPA	FEOA	TWUA	TWUA	TWUA	ALDA	BRC [4], IAM [9]	TWUA	TWUA	TWUA [8, 9, 15] AMA [16] UTSEA [17]
Transcontinental & Western	ALPA	FEIA	ALCEA, ARA	ALNA, TWUA	IAM [14, 1]	ALDA		ALS&SA	IAM	
United	ALPA	SA	ALCEA, ARA	TWUA	IAM	ALDA	IAM [7, 18]	ALSA [13]		SAM [18] IAM [19]
Western	ALPA		ALCEA, ARA		UAW	ALDA	BRC	ALSA [13]		UAW [20]
Hawaiian	ALPA		SA		SA	SA	SA	SA [13]		

[1] Also represents stockroom personnel.
[2] Separate agreement covers modification plant employees.
[3] An amendment to agreement covers modification plant employees.
[4] Includes teletype operators.
[5] Stockroom personnel only.
[6] Station managers only.
[7] Represents stockroom personnel and cargo handlers.
[8] Redcaps, ushers, and porters.
[9] Stationary firemen.
[10] Truckdrivers.
[11] Restaurant and flight kitchen personnel.
[12] Marine terminal porters.
[13] Stewardesses only.
[14] Also represents commissary clerks.
[15] Unskilled workers.
[16] Meteorologists.
[17] Transportation agents only.
[18] Technical engineers, architects, and draftsmen below rank of officials.
[19] mechanical department foremen.
[20] District maintenance managers, maintenance foremen and assistant foremen.
[21] Includes cleaners, porters, and utility men.

Union Guide

AAN—Assn. of Air Navigators.
ACCOA—Air Carrier Communication Operators Assn.
ACFEA—Air Carrier Flight Engineers Assn.
ALCEA—Air Line Communication Employes Assn. A. R. A.-C. I. O.
ALDA—Air Line Dispatchers Assn. A. F. of L.
ALFEA—Air Line Flight Engineers Assn. Int. A. F. of L.
ALNA—Airline Navigators Assn. T. W. U.-A. F. of L.
ALPA—Air Line Pilots Assn. A. F. of L.
ALSA—Air Line Stewardesses Assn.
ALS&SA—Air Line Stewards and Stewardesses Assn.
AMA—Airline meteorologists Assn.
BRC—Brotherhood of Railway and Steamship Clerks Freight Handlers, Express and Station Employes.
FCOA—Flight Communication Officers Assn.
FEIA—Flight Engineers International Assn.
FEOA—Flight Engineer Officers Assn.
FP&SA—Flight Pursers and Stewardesses Assn.
FROA—Flight Radio Officers Assn.
IAM—International Assn. of Machinists.
IBTCW&H—International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers, A. F. of L.
ROU—Radio Officers Union of the Commercial Telegraphers Union A. F. of L.
TWUA—Transport Workers Union of America, C. I. O.
UAW—United Automobile, Aircraft, Agricultural Implement Workers of America, C. I. O.
UTSEA—United Transport Service Employes of America, C. I. O.
SA—System Assn., committee or individual

increase has occurred since the war. There were 98 contracts on file at the end of the war, 139 in 1946, 168 in 1947, and 191 in 1948.

Two situations stand out in the table.

• **The Air Line Pilots Assn.** (A F L) has contracts covering pilots on all the major lines.

• **Three Unions**—International Assn of Machinists (Ind.), Transport Workers Union (C I O) and United Automobile Workers (C I O)—vie for the right to bargain for mechanics and ground service personnel.

ALPA has agreements with 33 regularly scheduled airlines, including all the major trunk and feeder lines. Its active membership has skyrocketed to 6274 from a prewar total of about 1000 in 1939. There are about 2000 inactive members.

With the bulk of the members among mechanics and ground service crews, the IAM has the edge over TWU and UAW. It claims some 15,000 members on 16 major lines. TWU has less than 10,000, and the UAW less than that.

IAM's Frank Heisler handles this union's airline activities with a field staff of 10 men. James Horst directs TWU's Air Transport division, which is undergoing a Communist housecleaning. UAW Vice President John W. Livingston runs UAW's Airline Department with help from J. L. McFarland, assistant director.

UAW is supposed to step aside for TWU now that this union is turning out the Communist leaders in accordance with current CIO policy. UAW became really active in the airlines to provide a CIO union for anti-Communists in the days when TWU followed the Communist party line.

U. S. Still Leads In Plane Milage

The U. S. is still flying more scheduled plane miles per week than all the rest of the world combined.

But the American share of the world's total has been declining steadily during the postwar period and is now about 51 percent, according to the Civil Aeronautics Board's Foreign Air Transport division. As of last Oct. 1, U. S. scheduled domestic and international carriers were flying 9,204,000 plane miles weekly, compared with 9,125,000 plane miles weekly for the airlines of other countries, including Russia.

Of the U. S. total, 7,072,000 plane miles weekly were flown by domestic carriers and 2,132,000 plane miles by American international flag lines.

▶ **Routes Compared**—CAB's latest world directory of scheduled common carriers shows U. S. domestic airlines operating 71,000 miles of unduplicated routes and U. S. international flag airlines 105,000 miles of unduplicated routes. (With duplications, U. S. carriers are certificated for 146,333 route miles domestically and 209,856 route miles internationally.)

In contrast to the U. S. total of 179,000 active unduplicated route miles the rest of the world has 932,000 active unduplicated route miles. But with the U. S. operating the majority of plane miles weekly, it is apparent that the number of flights operated by foreign countries over each mile of their routes is far less than with U. S. carriers.

Plane miles scheduled each week by all U. S. carriers have risen from 7,904,000 in October, 1946, to 8,627,000 in October, 1947, 8,976,000 in October, 1948, and 9,204,000 in October, 1949. In the same period, the rest of the world's scheduled plane miles weekly rose even more sharply, from around 4,436,000 in October, 1946, to 9,125,000 last year.

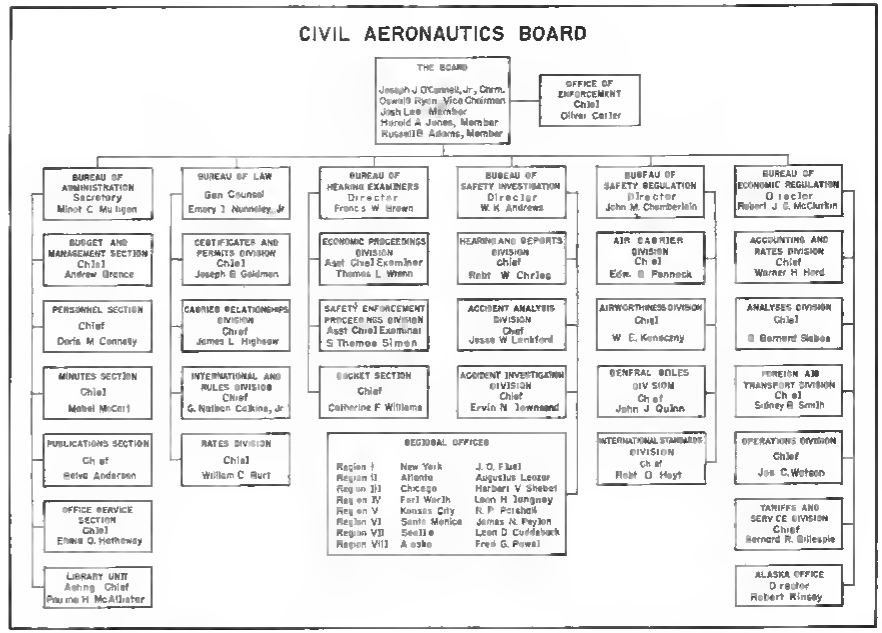
▶ **Soviet Progress**—Russia's record of 49,000 unduplicated route miles operated and 1,691,000 scheduled plane miles weekly as of last October is still far smaller than the U. S. total of 179,000 unduplicated route miles and 9,204,000 scheduled plane miles weekly. But Russia is moving up fast, increased its weekly scheduled plane mileage 27 percent between April and October, 1949.

Route by-route analysis shows that about 62 percent of the miles scheduled by all foreign airlines are performed with American manufactured aircraft. When U. S. airlines are included, the proportion of the world's scheduled airline operations conducted with American aircraft becomes 81 percent. Foreign aircraft perform 17 percent of the world's scheduled service, and two per cent is undeterminable.

CAB's survey covers 178 foreign airlines and 55 certificated U. S. airlines, including 16 Alaskan operators.

▶ **Ten Leaders**—The world's ten largest airlines from the standpoint of scheduled plane miles weekly in October, 1949, were Russia's Civil Air Fleet Administration (Aeroflot), 1,691,486; TWA, 1,278,347; Pan American Airways, 1,235,766; American Airlines, 1,166,902; United Air Lines, 1,137,948; Eastern Air Lines, 1,006,097; Air France, 521,076; Northwest Airlines, 496,794; KLM, 491,334; and BOAC, 453,147.

Ranked in order of unduplicated route mileage as compiled by CAB, the ten top airlines are: Air France, 76,450; KLM, 67,390; BOAC, 57,477; Pan American, 55,997; Aeroflot, 49,031; Sabena, 33,319; Scandinavian Airlines System, 31,300; Canadian Pacific Air Lines, 23,854; Philippine Air Lines, 22,642; and Panair do Brasil, 21,408.



Average Salaries

Average annual salary of domestic airline employes during 1948 was $3646. Pilots and copilots received average pay of $7656; flight engineers, flight communications officers, flight mechanics and navigation officers averaged $4498; stewards, stewardesses and pursers $2540; dispatchers meteorologists and communication operators $3344; mechanics $3765; other hangar and field personnel $3153; office employes $3034; and all others $2834.

Average annual salary of employes of U. S. international flag lines was $3594 in 1948. Pilots and copilots received an average of $9145; flight engineers, flight communications officers, flight mechanics and navigation officers averaged $6755; stewards, stewardesses and pursers $3141; dispatchers, communications operators and meteorologists $3213; mechanics $3388; other hangar and field personnel $3013.

U. S. Transport Aircraft

Manufacturer	Model	CAPACITY: Number of crew	Number of passengers	Cargo capacity (cu ft)	POWER PLANT: Number and make of engines	Take off hp.	At rpm at sea level	Normal rated hp.	At rpm	At altitude (ft)	Make of propellers	Diameter (in.)
Beech Aircraft Corp Wichita, Kan	D18S	1	8	. .	2 P&W R-985-AN14B	450	—	—	—	—	HS	99
Boeing Airplane Co Seattle, Wash	377 Stratocruiser	3-5	55-80	845	4 P&W R 4360	3500	2700	2650	2550	25 000	C HS	200
Consolidated Vultee Aircraft Corp. San Diego Calif	240 Convair-Liner	3	40	329	2 P&W R 2800-CA18	2400	2800	1600	2600	6,000	HS	157
Douglas Aircraft Co., Inc. Santa Monica Calif	DC-6	5-7	48-58	541	4 P&W R 2800-CA15	2400	2800	1800	2600	6,000	C,HS	157
	DC-6A-1135	3	None	5000	4 P&W R 2800-CB16	2400	2800	1600	2600	8 500	HS	157
	Super DC-3-1189A	3	31	282	2 Wr R 1820-C9HE [4]	1475	2800	1275	2500	3 500	HS	138
	DC-6B-1198	5	52-66	970	4 P&W R 2800-CB16	2400	2800	1800	2600	8 500	HS	157
Glenn L. Martin Co. Baltimore Md	2-0-2	3	36	346	2 P&W R 2800-CB16	2400	2800	1800	2600	8 500	HS	157
Grumman Aircraft Engineering Corp. Bethpage L. I. N.Y.	G-73 Mallard	2	10	. .	2 P&W R-1340-S3H1	600	2250	550	2200	5 000	HS	103
Lockheed Aircraft Corp Burbank Calif	749A Constellation	5-7	34-64	434	4 Wr 749C-18BD1	2500	2800	2100	2400	4 400	C,HS	. .

Model	PERFORMANCE: High speed (mph)	At altitude (ft)	Cruising speed, mph	At altitude (ft)	Take off distance (ft) over 50 ft obstacle	Landing distance (ft) over 50 ft obstacle	Landing speed (mph)	S L climb at gross weight (fpm)	S L climb with one engine inoperative (fpm)	Normal range (mi)	WEIGHTS: Gross weight (lb)	Empty weight (lb)	DIMENSIONS: Span	Length	Height overall	Direct operating cost per (passenger) (ton) mi
D18S	230	5,000	211	10,000	1760	1460	77[1]	1190	225	908	8,750	5 770	47' 7"	33' 11½"	9' 2½"	—
377 Stratocruiser	375	25,000	300	+25,000	6250[2]	. .	93	1100	.	4600	142,500	83,500	141' 3"	110' 4"	38' 3"	—
240 Convair-Liner	313	13,500	288	16,000	2250	2000[3]	108	1420	260	975	41 200	26,100	91' 9"	74' 8"	26' 11"	1 1¢/pas
DC-6	356	19 600	313	20 600	3720	2150[3]	91	1070	560	3820	97 200	51,495	117' 6"	100' 7"	28' 5"	.96¢/pas
DC-6A-1135	360	16 100	311	20 600	3950	2250[3]	93	1010	520	3560	100 000	49 767	117' 6"	105' 7"	28' 8"	5.2¢/ton
Super DC-3-1189A	270	5 900	251	15 400	2510	2490	77	1300	280	1425	31 000	19 537	90'	67' 8½"	18' 3"	.95¢/pas.
DC-6B-1198	360	16 100	311	20 600	3950[5]	2250[3]	93	1010	520	3560[6]	100 000	54 149	117' 6"	105' 7"	28' 8"	.97¢/pas.
2-0-2	312	14 500	286	12,000	3740	2320[3]	86	1790	460	1380	42 750	26 211	93' 3"	71' 4"	28' 5"	—
G-73 Mallard	215	6 000	168	8 000	1920	2340	—	1920	—	730	12,750	9,350	66' 8"	48' 4"	18' 9"	—
749A Constellation	354	19 200	300	23 000	3680	1500[3]	91	1230	640	—	107 000	59 000	123'	95' 3"	23'	—

C - Curtiss Electric
HS - Hamilton Standard

P&W - Pratt & Whitney
Wr - Wright

1 Stalling speed.
2 CAR field length.

3 With reversible props
4 Also available with P&W R-2000 engines.

5 Based on requirements for CAR 4b.
6 36 passengers and 1000 lb. of cargo

Comparative Safety Statistics

Scheduled Domestic Operations, 1938–1949
(U. S. Trunk, Feeder & Territorial Carriers)

Year	Fatal Accidents	Passenger Fatalities	Crew Fatalities	Pass. Miles Flown Per Pass. Fatality	Pass. Fatalities Per 100 Million Pass Miles
1938	5	25	10	22 400 205	4 5
1939	2	9	3	83 927 533	1 2
1940	3	35	10	33,114 118	3 0
1941	4	35	9	43 063 944	2 3
1942	5	55	16	27,286 599	3 7
1943	2	22	8	75,951 578	1 3
1944	3	48	8	47 907 077	2 1
1945	7	76	11	46 746,305	2 1
1946	9	75	22	80 894 782	1 2
1947	5	199	17	31 696 899	3 2
1948	5	83	15	75,035 325	1 3
1949	4	93	11	75,956,731*	1 3

Scheduled International Operations, 1938–1949
(U. S. Carriers)

Year	Fatal Accidents	Passenger Fatalities	Crew Fatalities	Pass. Miles Flown Per Pass. Fatality	Pass. Fatalities Per 100 Million Pass Miles
1938	2	7	10	7,601 860	13 2
1939	1	10	4	7 826 592	12 8
1940	0	0	0		0
1941	1	2	0	84,261,841	1 2
1942	0	0	0		0
1943	1	10	4	25 437 434	3 9
1944	1	17	0	18 737,317	5 3
1945	2	17	10	19,584,343	5 1
1946	2	40	12	28,150,765	3 6
1947	3	20	13	93,163,400	1 1
1948	1	20	10	98 089 700	1 0
1949	0	0	0		0

** Estimated subject to revision*
(Figures include both revenue and non-revenue passengers and passenger miles)
CAB statistics

Nonscheduled (Irregular) Air Carrier Aircraft

(Transport–Type Planes Only as of Jan 1, 1950)

CAA Regions	Certificated Operators	Douglas DC-4	Douglas DC-3	Curtiss C-46	Miscellaneous B-247	PBY	L-18	Total
1	14	5	9	5				19
2	19		19	28				47
3	3		3					3
4	4	1	6					7
5	None							0
6	19	11	26	7	1			45
7	8		7	9		1	1	18
8	9	2	4	4		1		11
9	1			1				1
International	3	14		13				27
Totals	80	33	74	67	1	2	1	178

Notes A. Includes operators certificated under Civil Air Regulation Part 45, in addition to Part 42.

B. Regional distribution of aircraft is based on location of principal maintenance base for particular aircraft involved.

C. Excludes aircraft which may be operated by scheduled air carriers in irregular service except when such aircraft are utilized in irregular air carrier operation only.

Source: CAA Air Carrier Maintenance Branch.

U. S. Airline Operations

U. S. INTERNATIONAL CARRIERS

(Traffic 1943–1949)

Year	Total Passenger Miles	Air Mail Ton Miles	Express Ton Miles	Freight Ton Miles
1943	254,374,000	1,990,715	(1)	(1)
1944	322,123,000	2,048,150	(1)	(1)
1945	462,180,000	3,399,339	(1)	(1)
1946	1,130,196,000	6,141,461	(1)	(1)
1947	1,863,268,000	12,755,998	30,786,465	2,109,948
1948	1,961,794,000	17,122,170	41,404,334	4,188,467
1949 (Est.)	2,144,000,000	20,220,000	50,968,000	7,500,000

(1) No segregation prior to Jan. 1, 1947.
1949 estimate by Air Transportation Association.

SCHEDULED DOMESTIC TRUNKLINES

(Traffic 1932–1949)

Year	Total Passenger Miles	Air Mail Ton Miles	Express Ton Miles	Freight Ton Miles
1932	127,433,000	2,701,125	289,512	(1)
1933	174,820,000	2,567,924	422,860	(1)
1934	189,806,000	2,461,412	597,293	(1)
1935	316,336,000	4,132,708	1,097,602	(1)
1936	438,989,000	5,740,436	1,865,798	(1)
1937	481,116,000	6,698,230	2,162,488	(1)
1938	560,660,000	7,449,246	2,182,420	(1)
1939	755,118,000	8,610,726	2,713,099	(1)
1940	1,157,900,000	10,117,858	3,476,224	(1)
1941	1,506,303,000	13,118,015	5,258,551	(1)
1942	1,501,279,000	21,162,102	11,901,793	(1)
1943	1,670,935,000	36,061,868	15,139,359	(1)
1944	2,211,905,000	51,139,973	16,991,598	(1)
1945	3,408,290,000	65,092,921	21,793,432	1,403,420
1946	6,068,315,000	32,953,307	23,788,392	14,822,325
1947	6,307,690,000	33,086,175	28,766,659	35,911,554
1948	6,227,932,000	37,925,396	30,092,833	71,283,727
1949 (Est.)	6,633,000,000	40,772,000	27,044,000	94,867,000

(1) Not available.
1949 estimate by Air Transport Association.

FEEDER AIRLINES

(Traffic 1946–1949)

Year	Total Passenger Miles	Air Mail Ton Miles	Express Ton Miles	Freight Ton Miles
1946	6,812,000	60,088	24,354	25
1947	53,452,000	176,790	131,925	83,772
1948	87,928,000	361,984	189,550	264,794
1949 (Est.)	135,750,000	415,500	308,200	450,000

1949 estimate by Air Transport Association.

(Figures for 1948 and preceding years include 16 domestic trunk lines, territorial carriers (Hawaiian and Caribbean Atlantic) and feederlines. 1949 estimate excludes feeders.)

U. S. Scheduled Air Transport Industry

DOMESTIC AIRLINES

Carrier	Assets (Sept. 30, 1949)	Employees (Sept. 30, 1949)	Payroll Per Year	Certificated Route Miles Jan. 1, 1950	Scheduled Rev Pass Miles, 1949	Scheduled Rev. Pass. Miles, 1948	Planes In Scheduled Service December, 1949
American	$125,972,000	11,831	$45,023,000	20,026	1,504,801,000	1,303,068,000	49 DC-6 18 DC-4, 73 Convair-Liner
foreign operations		349	377 000		64,660,000	49,973,000	
Braniff	14,172,000	2,212	7,686,000	4 831	196,882,000	193,806 000	6 DC-6, 9 DC-4, 16 DC-3
foreign operations		192	598,000	7,597	29,020,000	6,912 000	
Capital	13,013,000	3,195	12,121,000	5,810	351,284,000	275,770,000	25 DC-4, 24 DC-3
Chicago & Southern	7,447,000	1,286	4,677,000	6,119	106,936,000	105,173,000	6 DC-4, 13 DC-3
foreign operations		94	456,000	3,270	27,327 000	13,196 000	
Colonial	3,586,000	553	2,103,000	1,382	50,283 000	39 194 000	2 DC-4, 12 DC-3
foreign operations		26	163,000	2,030	9,943,000	13,016,000	
Continental	4,335,000	709	2,747,000	3,799	65,195,000	58,656,000	9 DC-3, 5 Convair-Liner
Delta	12,471,000	2,095	7,259,000	7,349	209,003 000	183,162,000	6DC-6, 6DC-4, 20DC-3
Eastern	53,852,000	7,635	28,461,000	13,202	997,020 000	965,264,000	18 DC-4, 51 DC 3, 7 L-749 Constellation, 13 L-649 Constellation
foreign operations		17	47,000	917	15,988 000	16,710 000	
Inland	968,000	209	948,000	1,913	31,328 000	26,852,000	1 DC-3
Mid-Continent	3,311,000	1,032	3,605,000	4,474	99,302 000	93,165 000	20 DC-3
National	8,428,000	1,678	6,166,000	2,702	168,804 000	90,442,000	4 DC-6, 9 DC-4, 11 Lockheed Lodestar
foreign operations		11	28,000	445	16,663,000	8,296,000	
Northeast	5,276,000	729	2,745,000	2,182	61,957,000	52,092,000	1 DC-4, 8 DC-3, 5 Convair-Liner
Northwest	45,118,000	4,160	17,203,000	11,130	419,750,000	325 283,000	18 DC-4, 2 DC-3, 24 Martin 2-0-2, 10 Boeing Stratocruiser
foreign operations		502	1,865,000	15,977	75,365,000	61,224,000	
TWA	88,858,000	8,863	34,577,000	11,582	929,043,000	847,677,000	13 DC-4, 63 DC-3, 12 L-749 Constellation, 23 L-49 Constellation, 5 Boeing 307
foreign operations		2,570	9,833,000	23,317	283,015,000	253,437,000	
United	102,392,000	9,742	38,541,000	15,881	1,266,963,000	1,155,974,000	39 DC-6, 29 DC-4, 69 DC-3
foreign operations		158	899,000	2,400	64,427,000	54,882,000	
Western	10,715,000	985	4,055,000	3,103	104,019,000	106,962,000	6 DC-4, 9 DC-3, 10 Convair-Liner
TOTAL (domestic)	$499,914,000	56,914	217,917,000	115,485	6,562,580,000	5,822,540,000	
(foreign)		3,919	14,266,000	55,953	586,408,000	477,646,000	
GRAND TOTAL	$499,914,000	60,833	232,183,000	171,438	7,148,988,000	6,300,186,000	

U. S. FLAG AND TERRITORIAL CARRIERS (1)

American Overseas	$26,753 000	1,347	5,116,000	9,134	180,861,000	172,604,000	6 DC-4, 1 DC-3, 7 L-49 Constellation, 7 Stratocruiser
Caribbean-Atlantic	444,000	147	353,000	388	5,881,000	4,680,000	3 DC-3
Hawaiian	2,732,000	437	1,781,000	402	41,273,000	48,184,000	12 DC-3
Pan American	162,651,000	15,075	57,840,000	127,930	1,178,000,000 (estimated)	1,134,340 000	63 DC-4, 10 DC-3, 20 Convair-Liner, 4 L-749 Constellation, 14 L-49 Constellation, 19 Stratocruiser
Panagra	18,030,000	1,788	5,181,000	10,653	105,386,000	103,663,000	11 DC-3 plus planes shared with PAA
Trans-Pacific	700,000	186	558,000	402	5,743,000	0	5 DC-3
TOTAL	$211,310 000	18,980	68 829,000	148,909	1,517,144,000	1,463,471,000	

FEEDERS IN OPERATION PRIOR TO SEPT. 15, 1949

All American	$3,091 000	442	1,473,000	1,954	9,854 000	0	10 DC-3
Challenger	809 000	115	106 000	2,394	8,261,000	5,352,000	4 DC-3
Empire	614,000	104	404,000	734	7,282 000	4,768,000	4 DC-3
Monarch	896,000	266	943 000	1,683	7,654 000	6,790,000	5 DC-3
Piedmont	1,523,000	311	982 000	1,904	18,516,000	9,296 000	8 DC-3
Pioneer	1,266,000	442	1,487 000	2,181	28,294,000	25,080,000	11 DC-3
Robinson	1,187,000	137	469 000	561	6,181 000	1,214,000	4 DC-3
Southern	706,000	182	659 000	1,332	1,753 000	0	5 DC-3
Southwest	1,256,000	271	1,030 000	1,272	20,947 000	17,785,000	9 DC-3
Trans-Texas	1,224,000	384	1,176 000	2,061	11,381 000	5,396,000	10 DC-3
West Coast	1,125,000	163	603 000	885	8,630,000	8,635,000	6 DC-3
Wisconsin-Central	1,075,000	198	747,000	1,712	4,943,000	1,953,000	6 Lockheed 10A
TDTAL	$14,772,000	3,015	10,079 000	18,693	133,896,000	86,269,000	

CERTIFICATED ALL-CARGO LINES

Airnews, Inc 2 DC-3
Flying Tiger Line 5 DC-4, 1 DC-3, 6 C-46
Slick Airways 18 C-46
U S Airlines 5 C-46

(1) Excludes certificated Alaskan carriers

Domestic Scheduled Airline Employment

1928–1949

Year (Dec. 31)	Total	Pilots and Copilots	Other [1] Flight Personnel	Pursers, Stewards, Stewardesses	Meteorologists and Dispatchers	Ground Mechanics	Other Hangar and Field Personnel	Office Employes	All Others
1928	1,496	508	0	0	0	525	665	0	0
1929	1,958	514	0	0	0	958	486	0	0
1930	2,778	616	0	0	0	1,416	746	0	0
1931	4,314	622	0	0	0	1,671	1,006	1,015	0
1932	4,020	640	0	0	0	1,641	959	800	0
1933	4,569	680	0	0	0	1,810	1,089	790	0
1934	4,201	667	0	0	0	1,650	925	961	0
1935	5,945	874	0	213	0	2,016	470	2,372	0
1936	7,079	1,055	0	333	0	2,164	546	2,981	0
1937	7,586	1,064	0	339	0	2,228	658	3,297	0
1938	9,008	1,135	0	358	186	2,430	712	3,715	472
1939	10,659	1,412	0	536	181	2,822	877	4,583	228
1940	15,984	1,939	18	914	193	4,054	1,880	5,855	1,131
1941	19,223	2,217	19	1,028	220	4,423	2,224	7,807	1,285
1942	26,910	2,194	112	753	1,581	9,348	2,969	7,717	2,236
1945	29,654	2,125	8	845	1,685	8,271	3,556	10,973	2,391
1944	31,198	2,879	11	1,322	1,870	7,136	3,509	12,201	2,270
1945	50,313	4,967	108	2,075	2,613	10,544	7,012	19,241	3,453
1946	69,182	5,712	98	3,342	3,577	16,107	10,307	24,626	5,413
1947	58,998	5,034	181	3,061	2,618	15,366	8,409	22,012	2,317
1948	60,416	5,307	312	3,058	2,612	16,428	9,222	21,396	2,101
1949*	60,699	5,378	597			14,456			

[1] Includes Flight Engineers, Flight Communication Officers, Flight Mechanics and Navigation Officers.
* As of Sept. 1949
Includes Domestic trunk lines, feeder lines and territorial carriers.
CAA-CAB statistics

U. S. International Flag Carrier Employment

1930–1949

Year (Dec. 31)	Total	Pilots and Copilots	Other[1] Flight Personnel	Pursers, Stewards, Stewardesses	Meteorologists and Dispatchers	Ground Mechanics	Other Hangar and Field Personnel	Office Employees	All Others
1930	697	81	0	0	0	405	211	0	0
1931	1,553	72	0	0	0	390	549	342	0
1932	1,590	77	0	0	0	435	576	502	0
1933	1,926	77	0	0	0	517	750	584	0
1934	2,276	92	0	0	0	558	928	698	0
1935	2,407	121	0	0	0	602	1,048	636	0
1936	2,916	186	0	57	0	710	1,221	742	0
1937	4,000	291	0	81	0	1,050	1,698	880	0
1938	4,266	278	0	93	0	977	1,925	995	0
1939	5,275	287	7	103	0	1,181	2,138	1,559	0
1940	6,067	340	15	122	0	1,359	2,397	1,834	0
1941	7,235	447	50	182	0	1,966	2,707	1,903	0
1942	12,805	952	129	378	29	3,534	4,415	3,366	0
1943	9,623	207	322	147	511	2,140	1,835	1,859	2,604
1944	11,409	466	266	194	631	2,827	2,239	3,033	1,753
1945	17,968	930	938	411	864	5,099	2,435	4,663	2,628
1946	27,372	1,508	1,405	1,079	1,454	7,269	2,463	6,961	5,233
1947	26,154	1,603	1,152	1,016	1,211	5,774	3,201	10,679	1,518
1948	23,726	1,620	1,203	1,105	1,042	5,345	2,362	9,608	1,441
1949*	22,129	1,670	1,111			3,771			

[1] Includes Flight Engineers, Flight Communication Officers, Flight Mechanics and Navigation Officers.
*As of Sept. 1949.
CAA-CAB statistics

Trans-Atlantic Traffic To and From the U. S.

Both Directions—1949

Carrier	No. Of Flights*	Percent Of Total Flights By All Carriers	No. Of Rev Passengers	Percent Of Total Rev. Pass By All Carriers	Average No. Of Rev Pass Per Flight
American Overseas	1,797 (1)	18.2	47,957	19.9	26.7
PAA	2,724 (212)	27.6	61,379	25.5	24.4
TWA	2,344 (99)	23.7	53,433	22.2	23.8
Total American Flag Carriers	6,865 (312)	69.5	162,779	67.6	24.8
Total Foreign Flag Lines	3,010 (67)	30.5	77,933	32.4	26.5
Total All Carriers	9,875 (379)	100.0	240,712	100.0	25.3

*Figures in parentheses denote number of cargo flights operated. Included in total flights.
(Foreign carriers included are Air France, BOAC, KLM, Sabena, Scandinavian Airlines System and Swissair.)

Both Directions—1948

Carrier	No. Of Flights*	Percent Of Total Flights By All Carriers	No. Of Rev Passengers	Percent Of Total Rev. Pass. By All Carriers	Average No. Of Rev. Pass. Per Flight
Air France	742 (1)	7.9	17,385	8.0	23.5
American Overseas	1,983 (28)	21.1	48,376	22.3	24.7
BOAC	503	5.3	12,941	6.0	25.8
KLM	607 (62)	6.5	12,898	5.9	24.6
PAA	2,409 (97)	25.6	55,926	25.7	24.2
Sabena	272 (57)	2.9	4,195	1.9	19.5
SAS	533	6.7	15,097	6.9	23.8
Swissair	32	.3	787	.4	24.6
TWA	2,227 (121)	23.7	49,681	22.9	23.6
Total American Flag Carriers	6,619 (241)	70.4	153,983	70.9	24.1
Total Foreign Flag Lines	2,789 (140)	29.6	63,343	29.1	23.0
Total All Carriers	9,408 (381)	100.0	217,326	100.0	24.1

*Figures in parentheses denote number of cargo flights operated. Included in total flights.

Both Directions—1947

Carrier	No. Of Flights*	Percent Of Total Flights By All Carriers	No. Of Rev. Passengers	Percent Of Total Rev. Pass. By All Carriers	Average No. Of Rev. Pass. Per Flight
Air France	386 (1)	4.9	10,452	5.1	27.1
American Overseas	1,923 (20)	24.2	49,844	24.5	26.2
BOAC	519 (1)	6.5	13,549	6.7	26.2
KLM	423 (9)	5.3	11,236	5.5	27.1
PAA	2,391 (72)	30.1	62,838	30.5	26.8
Sabena	148 (12)	1.9	3,414	1.7	25.1
SAS	618	7.8	12,541	6.2	20.3
Swissair	8	0	9	0	0
TWA	1,522 (87)	19.3	40,642	20.0	28.1
Total American Flag Carriers	5,846 (179)	73.6	152,524	74.9	26.9
Total Foreign Flag Lines	2,094 (23)	26.4	51,192	25.1	24.7
Total All Carriers	7,940 (202)	100.0	203,716	100.0	26.3

*Figures in parentheses denote number of cargo flights operated. Included in total flights.

Britain—Useful Arsenal in World Power

By Frederick R. Brewster

(McGraw-Hill World News)

London—Britain's place in the grand strategy of Allied air power is becoming perfectly clear. And, though little awareness of this is allowed to penetrate into the consciousness of the British public, the signs all point to only this conclusion: Britain is an essential arsenal, but it is not considered a source of striking power.

Such a subordinate position may not suit the British pride—but it does fit in with the reduced productive potential that Britain can afford to allot defense, in her present straits. It also is a realistic decision.

The relative state of progress in British aircraft development has brought to a high degree of perfection the jet-propelled fighter plane, the gas-turbine engine, and civil transports embodying these engines, but lags in the development of long-range and high bombload capacity bombers.

► **Independence**—This doesn't mean that Britain has accepted her subordinate status as a permanent state. That would be to misjudge seriously the British desire to be politically, economically and militarily independent. Developments underway, though scarcely talked about and still under security wraps, aim at future full-scale independence in the aviation field. Swept wing jet bombers, higher-powered axial-flow turbojet engines, civil transports superior to any others in the world—these are only a few of the projects that can be glimpsed but not described, on which the British aircraft industry is working.

But for the present, in the grand plan being cooked up under the sponsorship of the North Atlantic Pact, Britain comes in as a producer of fighter aircraft and her Air Force is counted on mainly to defend the home country so that it can continue to turn out more and more fighters.

Only one light bomber, the Canberra, has so far been developed in Britain, tested, and ordered into production since the war—and this sleek swift craft carries only a small load of destruction. It may be given the job of tactical bombing in support of front line infantry, where its tremendous speed, upwards of 500 mph., its fighter-like maneuverability, and its own secret defense device, can be counted on to see that it accomplishes its missions without fighter protection.

► **B-29s Accepted**—The two four-jet sweptwing long range bombers which were commissioned more than four years ago have yet to fly, and it would be another three years before they could be delivered in quantity for use by RAF's Bomber Command. So, with evident reluctance, the RAF accepted the 70 surplus B-29s from the USAF, with all the problems of familiarization, training, and maintenance that is implied thereby. But with the Lincoln unable to meet the high-altitude requirement of present-day bombing, there was no option.

For long range ocean reconnaissance, where duration rather than speed is to be desired, Britain favors the AVRO Shackleton, and has ordered AVRO to commence series production on this further development of the famed Lancaster wing. But the Shackleton, obviously, fits into a scheme of defending the British Isles, and keeping open the sealanes of supply, rather than any plan of offensive striking power.

In fighters, development of the tried and trusted Vampire and Meteor jet jobs continues. And orders from foreign countries—Sweden, Norway, Denmark, Switzerland, Italy, Egypt, for the Vampire, Belgium, Holland, France, for the Meteor—are all in keeping with the pattern of planning as well as helping Britain's aircraft builders keep their heads above water and the nation as a whole with necessary export earnings.

Production of the Vampire in Sweden and France and Italy, and of the Meteor in Holland, as well as manufacture of the de Havilland turbojet engines and the Rolls Royce Nene jet engine abroad, in Sweden, France, Belgium, and Italy, also emphasize Britain's key place in the European aircraft production pattern. Assuming that there may not be the long years of preparation for the next war that there were the last time, the good sense is obvious of this present arrangement, providing an early form of dispersed production, and a high degree of familiarity with the two excellent fighter types among all Western European countries.

► **Planning Still Primitive**—It is giving away no secret to state that inter nation planning under the North Atlantic Pact is still in its very early stage. And the first meeting in London, in mid-January, of American officers of the three services charged with the local liaison activities in Europe, was still one limited to discussing administrative procedures, channels of communication, manner of payments, etc., rather than an initial "strategic plan" session.

The Brussels Treaty powers—Belgium, Holland, Luxembourg, France, and Great Britain—who had taken an earlier step toward integration of their forces—were still in the dark, when their London headquarters was asked how they would fit in with the larger program of mutual assistance under the North Atlantic Pact. "We're still waiting to hear," they replied.

A recent RAF reshuffle of its top-layer organization to make ready for future integration goes into effect Mar. 1. Under it, Air Chief Marshall Sir John Slessor, CAS, will have Sir Ralph Cochrane, Vice Chief of the Air Staff, to run the RAF, and Sir Arthur P. M. Sanders, who steps down from the Vice-Chief's post to become a new Deputy-Chief, in charge of inter service policy and planning, and to handle cooperation with Commonwealth and allied air forces.

► **Transport Cuts**—Significant, too, is that when cuts had to be made in all Government departments' spending, the cuts in defense expenditure for aircraft fell not on fighter production, but on airframes and engines for RAF's Transport Command.

This step, taken after inter service consideration, was merely a continuation of Britain's long standing decision that fighter defenses were its top priority, and that civil and transport aircraft followed after. There's no evidence that this decision was talked over with MDAP officials, but if it had been, they would undoubtedly have approved the proposition.

► **State of the Industry**—Britain's aircraft builders are still in that twilight zone, between sickness and health, that generally marks the industry in inter-war years. During the past year, new developments continued to outweigh quantity production, by far. But there are signs that the wheels may begin to turn a bit faster in aircraft factories in 1950.

Besides the Canberra and the Shackleton, these other new types, flown for the first time in 1949, have been ordered into production: de Havilland D.H. 113 night fighter, D.H. 112 high altitude fighter, and the Meteor 8 fighter. All three are primarily advanced types of tested designs.

The Hawker Sea Hawk jet fighter, flying since September, 1947, has at last been ordered for service with the Royal

Ministry of Supply Expenditures

	April 1, 1949–Mar. 31, 1950	1948–49	1947–48	1946–47
Aircraft, airframes and airframe repairs				
(Military)	£32,713,000	£32,800,000	£33,497,000	£113,055,000
(Civil)	2,876,000	5,680,000		
Airframe spares, propellers and gun turrets				
(Military)	14,015,000	14,169,000	12,574,000	
(Civil)	32,000	82,000		
Aero engines, aero engine spares and repairs				
(Military)	18,739,000	20,300,000	20,980,000	38,674,000
(Civil)	154,000	320,000		

Source: Civil Estimates.

British Airways

	British Overseas Airways Corporation (incl. BSAA)		British European Airways	
	1949	1948	1949	1948
Total passengers carried	150,000	136,000	709 203	565 457
Total passenger-miles flown	408 600 000	404 500 000	201 209,498	150,726,092
Total cargo (tons) (includ excess baggage)	3,969	3 740	5,795	4.430
Total mail (tons)	1,767	1 970	3,476	2,277

Leading Canadian, British & French Planes

Manufacturer	Designation	Category	Number of crew (or places)	Number of passengers	POWER PLANT: Number and make of engines	Normal rated hp. ea.	At rpm.	PERFORMANCE: Cruising speed (mph)	At altitude (ft)	S. L. climb at gross weight (fpm)	Normal range (mi.)	Service ceiling (ft.)	WEIGHTS: Gross weight (lb.)	Empty weight (lb.)	DIMENSIONS: Span	Length	Height	Top speed (mph)	At altitude (ft)	Remarks
CANADA																				
A. V. Roe Canada, Ltd.	C-102 Jetliner	Transport	4	40-60	4 R-R Derwent 5	3600[1]	14,700	465	30 000	2770	600		65,000	33 400	98' 1"	82' 9"	36' 5.5"	500+	30 000	Basic price $700,000
	CF-100	Fighter	2	...	2 R-R Avon	7500[1]														Prototype being tested
Canadair, Ltd.	C-4	Transport	4	36-55	4 R-R Merlin 626	1500	2850	325	25,200	1100	3880[2]	...	82,000	46 807	117' 5"	93.62	27.53'	329	20 600	Cargo capacity 598 cu.ft
Canadian Car & Foundry Co., Ltd	N-29 Norseman 5	Transport	1-2	8-9	1 P&W R 1340 AN-1	550	2250	141[3]	5000	700	464	...	7400[3]	4250[3]	51' 8"	32' 4"	10' 1"	155[3]	5000	Basic price $31 900 less engine
de Havilland Aircraft of Canada Ltd.	DHC-1 Chipmunk	Trainer	2	...	1 DH Gipsy 1C	130	2100	134	5000	900	485	17 200	1930	1184	34' 4"	25' 5"	7'	140	2400	Basic price $10,150
	DHC-2 Beaver	Transport	1	6	1 P&W R 985 AN-6B	400	2200	153	5000	1290	578	26 000	4650	2775	48'	30' 3"	10' 7"	171	S.L.	Basic price $26,450 in U.S.
GREAT BRITAIN																				
Airspeed Ltd	AS-57 Ambassador	Transport	4-5	40-50	2 Br Centaurus 661	2313	2,500	280	20,000	1600	850[4]	...	52,000	34 650	115'	81.3'	18.25'	312	21 500	$320,000 basic, 20 on order
Armstrong Whitworth Aircraft, Ltd	AW-55 Apollo	Transport	3-4	24-40	4 AS Mamba 1	659[5]	14 000	276	20 000	1500	1100	...	45,000	28 750	92'	72'	28'	345	20,000	Approx. $360,000 equipped. 2 on order
A. V. Roe & Co., Ltd.	701 Athena T.2	Trainer	2		1 R-R Merlin 35	1040	2650	277	10 000	1830	640	29,700	8132	6542	40'	37' 6"	13'	300	10,000	...
	707	Research	1	...	1 R-R Derwent	...	...	...	...	...	...	...	...	...	33'	30'	11' 3"		...	Swept wing high-speed research
Auster Aircraft, Ltd.	Autocrat J/1	Personal	3	...	1 BI Cirrus Minor 2	100	...	92	...	500	320	15,300	1700	1052	36'	23' 5"	...	110	...	$3776, dual controls, flaps
	Aiglet J/1B	Personal	3	...	1 DH Gipsy Major 1	130	...	100	...	200	220	18 000	1850	1180	36'	23' 4"	...	128	...	$3180
	Arrow J/2	Personal	2	...	1 Con	75	...	80	...	500	320	10 000	1400	872	35'	22' 11"	...	98	...	$2660 for export
	J/4	Personal	2	...	1 BI Cirrus Minor 1	90	...	86	...	700	320	12 500	1400	957	36'	23' 6"	...	110	...	$3300
	J/5	Personal	3	...	1 DH Gipsy Major 1	130	...	98[6]	...	600	390	12 000	1850	1186	36'	23' 2"	...	120[6]	...	$3920 flaps
	Autocar J/5B	Personal	4	...	1 DH Gipsy Major 1	130	...	98	...	620	500	13 500	2100	1305	36'	23' 4"	...	115	...	$4410 latest model
	Avis 1	Personal	4	...	1 DH Gipsy Major 10	145	...	90	...	510	520	10 000	2550	1480	36' 4"	23' 5"	...	113	...	
	Avis 2	Personal	4	...	1 DH Gipsy Major 10	145	...	90	...	510	520	10 000	2550	1438	36' 4"	23' 6"	...	113	...	Convertible to ambulance
	Mk. 5	Personal	3	...	1 Lyc	130	...	100	...	770	220	15,000	1820	1088	36'	22' 6.75"	...	125	...	$2520 mil reconversion
	Mk. 7	Trainer	3	...	1 DH Gipsy Major 7	145	...	107	...	660	350	12,000	2122	1469	36'	23' 9"	6' 6"	122	...	Also observation, communications plane
Blackburn & General Aircraft, Ltd	G.A.L. 60 Universal Freighter	Transport	4	90	4 Br Hercules 361	1610	2400	176	3250	755	1000	...	100,000	58,599	162'	98'	31'	240	5000	In production
	B 46 Firebrand 5	Strike	1	...	1 Br Centaurus 9	1180	2400	363	10,000	2500	740	28,500	15 317	11,878	51'	39'	15'	350	13 000	Naval fighter-bomber
	Y. A. 5	ASW	...	...	1 R-R Griffon 7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Anti-submarine
Boulton Paul Aircraft Ltd.	P. 108A Balliol T.2	Trainer	2	...	1 R-R Merlin 35	1245	5000	280[8]	10,000	2230	525	32 600	8336	6556	39.33'	35.125'	12.5'	305	11 500	...
Bristol Aeroplane Co Ltd.	164 Brigand B 1	Bomber	3	...	2 Br Centaurus 57	1970	2400	200	10,000	1455	...	35 300	39,000	26,000	72' 4"	46' 4"	11' 5½"	360	16 300	Light bomber
	167 Brabazon 1	Transport	...	...	8 Br Centaurus 20[9]	1970	2400	...	...	...	...	...	200 000	...	230'	177'	50'	...	...	One built-research plane only
	167 Brabazon 1B	Transport	...	...	8 Br Proteus 3[9]	3350[13]	...	...	...	...	...	...	...	...	230'	178' 10"	50' 8"	...	...	Three ordered
	170 Wayfarer 21E	Transport	3	32	2 Br Hercules 672	1530	2400	162	5000	1090	1420[2]	...	40 000	20,091	108'	68' 4"	21' 6"	224	5600	Also freighter, ambulance types
	175	Transport	...	50-62	4 Br Proteus[10]	...	...	...	...	...	2300	...	...[11]	...	140'	114'	36' 8.3"	...	...	BOAC ordered 25
Chrislea Aircraft Co., Ltd.	C.H.3 Skyjeep 4	Personal	1	3	1 BI Cirrus Major 3	145	2200	114	2500	550	520	...	2550	1550	36'	22'	6' 4"	127	2500	Basic price $6300
de Havilland Aircraft Co., Ltd.	D.H. 100 Vampire F 6	Fighter	1	...	1 DH Goblin 3	3350[1]	10 750	380	30 000	3700	945	48 500	12 390[12]	7283	38'	30' 9"	6' 2"	548	S.L.	Also supplied to other nations
	D.H. 112 Venom	Fighter	1	...	1 DH Ghost	5000[1]	10 000	...	...	...	...	...	...	...	41' 9"	31' 5"	...	...	...	
	D.H. 106 Comet	Transport	4	36-48	4 DH Ghost	5000[1]	10 000	490	36 000	...	...	...	105 000	...	115'	93'	28' 5"	...	...	Est. rated price $1,250,000
	D.H. 104 Dove	Transport	2	8-11	2 DH Gipsy Queen 70-2	345[13]	2400	179	8000	850	600	...	8500	5657	57'	39' 6"	13' 4"	210	8000	Basic price $49,000, 300+ ordered
English Electric Co., Ltd.	Canberra B.1	Bomber	2	...	2 R-R Avon	...	...	...	...	...	...	...	...	...	64'	65' 6"	15' 6"	...	...	...
Fairey Aviation Co., Ltd.	Advanced Trainer	Trainer	2	...	1 R-R Griffon 12	...	...	...	...	...	...	...	12,000	...	44' 6"	37' 7"	...	...	...	Trainer version of Firefly
	Firefly MK 5	Fighter	2	...	1 R-R Griffon 74	2250[13]	2750	...	...	...	760	...	13,479	9946	41' 2"	38'	16' 6"	...	...	...
	Fairey 17	Strike	2	...	1 AS Double Mamba	2540[14]	15,000	...	...	...	...	...	...	...	...	...	...	...	...	Experimental anti-submarine aircraft
Gloster Aircraft Co. Ltd.	Meteor F.4	Fighter	1	...	2 R-R Derwent 5	3500[1]	14,350	555	S.L.	7350	340[15]	44,600	15 175[16]	10 740	37' 2"	41'	13'	585	S.L.	Standard RAF and West Europe fighter
	Meteor T.7	Trainer	2	...	2 R-R Derwent 5	3500[1]	14,550	530	S.L.	7920	520[16]	46,000	14,000	10,290	37' 2"	43' 6"	13'	585	S.L.	Two seater jet trainer
	Meteor F.8	Fighter	1	...	2 R-R Derwent 5	3500[1]	14,550	...	...	...	...	...	...	...	37' 2"	44' 7"	13' 10"	...	...	Replaces Meteor 4
Handley Page, Ltd.	Marathon 1	Transport	2	22	4 DH Gipsy Queen 70-2	308	2600	200	5000	683	1030	...	18 000	11,946	65'	52'	14' 1"	233	6750	Order of 40 may be cut back
	Marathon 2	Transport	2	22	2 AS Mamba	1128[17]	15 000	355	10,000	1860	980	...	18 000	10 582	65'	52'	14' 1"	290	20,000	Turbo prop version of Marathon 1
	Hermes 4	Transport	7	40-74	4 Br Hercules 763	1600	2400	283	24 000	1030	3554	...	82,000	54,624	113'	97'	30'	357	20,000	25 ordered
	Hermes 5	Transport	7	40-74	4 Br Theseus	2020[13]	9000	352	20,000	2325	3040	...	90 000	52,887	113'	97'	30'	355	15,000	Tricycle gear
	Hastings	Cargo	5	...	4 Br Hercules 101	1475	2600	302	23,500	990	3886	...	60 000	48,427	113'	81' 8"	22' 6"	347	22,200	3000 cu ft. cargo cap.
Percival Aircraft, Ltd.	Prince 50	Transport	2	8-12	2 Alvis Leonides 501-4	440	2900	212	10,000	1115	650	...	10,650	7397	56'	42' 10"	16' 1"	225	5000	Feeder line transport
	Prentice 40	Trainer	3	...	1 DH Gipsy Queen 32	250	...	139	1000	655	...	13,600	6000	3232	46'	31' 6"	8'	...	...	RAF basic trainer
Saunders-Roe, Ltd.	Princess SR/45	Transport	8	105	10 Br Proteus[18]	3500[18]	...	360	35 000	...	5500[2]	...	315,000	190,000	219' 6"	146'	55' 9"	...	...	Still under constr.
Short Bros. & Harland, Ltd.	Sealand	Transport	2	5-7	2 DH Gipsy Queen 70	275	2600	173	7750	950	645	...	9100	7319	59'	42' 7"	14'	188	5250	At least 3 ordered by BWIA
	Solent 4	Transport	6	45-80	4 Br Hercules 733	1610	2400	200	10,000	1120	1450	...	79,000	49,000	112' 10"	87' 7"	37' 3"	280	3000	Flying boat
	Sturgeon T.T. 2	Target tow	2	...	2 R-R Merlin 160	1440	2850	312	15,000	2470	1152	33,000	22,100	17,647	59' 8"	48' 11"	19'	366	24,300	Royal Navy
	702A Viscount	Transport	4	40-53	4 R-R R.Da. 3	1400[13]	14,600	338	15,000	1700	1740	...	50,000	31,595	94'	81' 2"	36.75'	...	...	Basic price $476,000, about 40 ordered
	Valetta C. 1	Transport	4	35	2 Br Hercules 230	1645	2400	265	10,000	1300	520	...	36,500	35,543	89.25'	65'	19.5'	294	5600	RAF transport about 200-250 on order
	Varsity	Trainer	...	...	2 Br Hercules	...	...	...	...	...	...	...	37,500	...	95.5'	67.5'	24'	...	...	RAF bomber crew trainer
	Attacker	Fighter	1	...	1 R-R Nene	5000[1]	...	520	30 000	6250	1190	48 500	14 055	7798	36.37'	37'	9.5'	586	S.L.	In production for Royal Navy
	510	Fighter	1	...	1 R-R Nene	5000[1]	...	...	...	...	...	...	...	...	38.64'	38'	8.81'	...	...	Attacker development project
Westland Aircraft, Ltd.	Wyvern T.F. 2	Fighter	1	...	1 AS Python	3670[19]	6000	...	...	...	...	...	...	...	44'	42'	...	...	...	Royal Navy torpedo plane-fighter
FRANCE																				
S. A. des Ateliers d'Aviation Louis Breguet	763	Transport	4+	130	4 P&W R 2800 CA-18	1600	2600	224	...	...	2367	...	95,000	52,636	140' 10"	94' 11"	31' 4"	248	...	15 on order
	890 H Mercure	Transport	2	...	2 Br Hercules 739	...	...	186	...	...	621	...	39 600	22,330	110' 5"	70' 10"	23' 7"	236	...	
	891R Mars	Transport	5	...	2 SNECMA 14R-200	1282	...	186	...	836	1242	26,500	37 147	25,352	100.4'	71'	23' 7"	261	13 000	Military freighter
	892S Mercure	Transport	3	40	4 Ren 12S 02-201	390	3100	177	4920	...	621	...	35,200	19,778	100' 5"	70' 10"	23' 7"	218	8200	
Avions Hurel Dubois	HD 10	Research	1	...	1 Mathis G 2 F	32	2600	115	SL	400	800	12,000	1150	770	40'	18'	4.2'	135	SL	High aspect ratio wing plus lift struts
Fouga & Co.	CM8. R13 Cyclone	Personal	1	...	1 Turbomeca	276[1]	...	150	SL	790	185	28,000	1182	805.4	42' 7.75"	21' 10"	5' 10"	162	15 000	Glider with gas turbine
	CM 100	.....	2	18	2 Ren 12 S02-201	495	3250	158	6000	500[2]	...	...	15,600	11 000	88'	59'	19'	160	7500	...
Aeroplanes Morane Saulnier	MS 700	Personal	4	...	2 Potez D33	160[13]	...	161	3280	945	745	20,340	4885	3620	46' 7"	32' 6"	11' 2"	180	4920	...
SIPA	S 11	Trainer	2	...	1 Ren 12S 00	390	3100	205	...	1772	435	27 230	4563	3699	36' 11"	30' 7.25"	8'	223	7875	Advanced trainer
	S 901	Personal	2	...	1 Mini 4 DC-30	70	2200	110	1000	455	320	12,200	1320	795	27'	18'	5.2'	125	SL	...
S.N.A.C.	N.C. 211 Cormoran	Trainer	4	131	4 GR 14R	1200	...	199	9840	...	1243	...	92,593	59,910	144' 4"	100'	33' 1.5"	249	9840	...
	N.C. 702 Martinet	Transport	2	8	2 Ren 12 S 00	495	...	202	9840	...	503	...	12,344	8741	71' 7.25"	42'	14' 5.5"	217	9840	...
	N.C. 853	Personal	2	...	1 Mini 4 DC-32	70	2700	87	...	460	310	7000	1408	801	36' 11"	22' 5"	...	95	...	100 ordered
	N.C. 1071	Torpedo	3	...	2 Hispano – Nene	4600	12,000	476	13,120	4725	...	43,330	25 190	16,259	65' 7"	34' 6"	14' 9"	492	19 680	...
S.N.A.S.E.	S.E. 161 Languedoc	Transport	6	33	4 GR 14 N 68/69	1020	2400	233	7548	591	1678	...	45,364	27 890	95' 5"	79' 7"	16' 10"	290	SL	100 ordered
	S.E. 1010	Photo	...	...	4 SNECMA 14R 28/29	1335	2400	248.6	33,000	...	3110	...	72,160	39 000	101.6"	71.54'	21'	323	SL	High-altitude photo-survey plane
S.N.C.A.S.O.	S.E. 2010 Armagnac	Transport	6	84	4 P&W R-4360 B-13	3650	2550	296	19,680	...	3600	...	165 000	81 633	160' 7"	129' 10"	44' 3.5"	335	19 680	15 ordered
	S.O. 30P Bretagne	Transport	4	36	2 P&W R-2800 CA 18	1800	2600	273	17,400	...	853	...	42,150	27,350	88' 4"	62' 1.5"	19'	304	18 000	45 ordered
	S.O. 95 Corse 2	Transport	2	10-13	2 Ren 12 S02-201	390	3100	218	8860	...	750	...	12 346	9016	59'	40' 5"	14' 1"	221	S.L.	60 ordered
	S.O. 6000 Triton	Fighter	2	...	1 Hispano-Nene 109	4600[1]	12 000	594	SL	9840	600[20]	30,000	10 032	7050	32' 8"	34' 2"	...	630	S.L.	...
	S.O. 6020 Espadon	Fighter	1	...	1 Hispano-Nene 102	4600[1]	12 000	700	30,000	5500	...	36 000	17 640	11 297	34' 9"	48' 2"	...	647	S.L.	Six 15-mm. guns
	S.O. 7060 Deauville	Personal	3	...	1 Walter Minor 4-111	60	2300	106	3280	...	400	...	1760	1140	34'	21' 11"	7' 11"	127	....	Two prototypes built
	S.O. 8000 Narval	Fighter	1	...	1 Arsenal 12H 02	1740	...	...	...	...	...	21,000	15430	...	38' 6.5"	38' 8.5"	...	453	25,000	Pusher-engine carrier fighter
	S.O. M2	Research	1	...	1 R-R Derwent 5	4000[1]	14,000	...	...	...	...	...	10,340	8450	29' 5.5"	39' 5.5"	...	...	...	Flying model of S.O. 4000

* – approximate
AS – Armstrong Siddeley
Bl – Blackburn
Br – Bristol
Con – Continental
DH – de Havilland
GR – Gnome Rhone
Lyc – Lycoming
Mk. – Mark
P&W – Pratt & Whitney
Re – Renault
R-R – Rolls-Royce
SL – sea level
1 – pounds thrust
2 – maximum range
3 – As landplane. Seaplane gross weight is 7540 lb., empty is 4700 lb.
4 – At 280 mph, with maximum payload
5 – Estimated engine shaft hp.
6 – With metal prop.
7 – Fitted to prototype. Production model is designed to use turboprop, probably Armstrong Siddeley Double Mamba
8 – With rich fuel mixture
9 – Four coupled installations
10 – Or 4 Bristol Centaurus 663 piston engines
11 – Payload is 17,610 lb.
12 – With bombs and rockets
13 – Takeoff hp.
14 – Given is shaft hp., there is also 770 lb thrust
15 – At 40,000 ft, without drop tanks
16 – Without drop tanks
17 – Engine shaft hp.
18 – Eight in four coupled installations, two as single units
19 – Maximum takeoff shaft hp.
20 – Duration is 1 hr. 30 min.

Navy as a counterpart to the Super marine Attacker, ordered a year ago. The swept-wing versions of both of these single-jet fighters have been going through the testing wringer, but have not been ordered yet, although a report from Australia suggests that the Hawker P.1052 may go into production out in the Antipodes, as will the Canberra.

▶**Pistons for Navy**—Meantime, Hawker Sea Furies and Fairey Fireflies are being turned out for the Royal Navy and other navies who still want piston-engined fighters for deck-landing service.

Short Brothers, having completed its production of giant Solent flying boat transports, was left with nothing but a small order for Sturgeon target-towing planes, and scattered orders for the little eight-seater Sealand amphibian transport.

Bristol, in addition to all its other activities, rolled out twin-piston-engined Brigands for air-reconnaissance and light tactical service with the RAF.

The rest of the industry existed on subcontracts for major components from these builders, notably for Vampire and Meteor wings, tail assemblies, etc.

▶**Transport Orders Rolling**—Although the year saw Britain regain its superiority over the Americans in transport aircraft design, with the jet-powered Comet and the turboprop Viscount, Apollo, Hermes, 5, and Marathon 2, only Handley Page was fully occupied on transport production during the year, with orders for 25 Hermes piston-engined 60 passenger airliners and 40 Marathon 1 piston engined feederliners. De Havilland, whose Dove feederliner has captured a nice batch of more than 300 orders in the past years, added series production of the Comet to its program in the latter part of the year, and Vickers Armstrongs could start thinking about production schedules for the Viscount in September after it finally landed an order for nearly 40 when many observers thought the project was a dead duck.

The gigantic Brabazon 1 made its first flight early in September and production of the three turboprop versions continued at a slow pace, as did construction at Cowes of the three Princess flying boats of Saunders Roe.

Compared to wartime production, current production figures are puny. This is reflected in the total employes in the aircraft and aircraft engine building industry—which has dwindled from 1,800,000 in January, 1944, the wartime peak, to only 152,000 in November, 1949. Wartime production of course required enormous subcontracting throughout British industry an asset in terms of knowledge and potential capacity, which is not exactly wasted away, but which would require longer to re-establish than the circumstances of an other war might permit.

▶**The Civil Picture**—All is far from healthy in the civil aviation field in Britain. BOAC has swallowed up BSAA without gaining any of the economies usually associated with merger, BOAC and BEA are going through the agonies of reorganization at the top, again and yet again.

Traffic handled by both the nationalized airlines continued to increase during the year. But the besetting problem of BOAC—inefficient, uneconomic aircraft—has only been alleviated, not cleared, by the arrival of additional Connies and the new Stratocruisers, and the problem of maintaining a wide variety of types in its fleet is made no less serious.

The charter companies, on whom the bulk of the work of the Berlin airlift fell, and whose value as a reserve of air power in such an emergency was well demonstrated at that time, have had lean pickings since the airlift ended.

▶**Expenditures**—Up until the recent cuts in expenditure on equipment for Transport Command, estimated expenditure for aircraft, spares, and engines by the Ministry of Supply (who places all contracts for the military services and until recently for the nationalized airline corporations as well) in the financial year ending March 31, 1950, was £65.4 million for military equipment and £3.1 million for civil aircraft types.

This report would scarcely be complete if it did not include a comment that the British aircraft industry is still indignant about the country's purchases of American transport aircraft. The SBAC, in a release dated Feb. 8, gives currency to the fact that imports (which include in 1949 the cost of the 22 Canadian Fours, as well as the cost of BOAC's Stratocruisers) have risen to a total of £17 million, contrasted to only £1 million in 1946—i.e. to nearly half of the country's aircraft export figure (£34 million, including tires and accessories) from less than 10 percent recorded during 1946.

Brazil's Airports

Brazil has about 200 airfields on which two-motored commercial planes can land and take off, according to a survey by the Ministry of Aeronautics. A few are unusable during the rainy season.

There are six airports available to four-motored craft: Val de Cans at Belem, Parnamirim at Natal, Recife, Caleão and Santa Cruz at Rio de Janeiro, and Cumbica which is located at São Paulo.

France

Takes first steps of long climb to become first-rank air power

By Boyd France

(McGraw-Hill World News)

Paris—Nineteen fifty will be the most significant year for French aviation since it was swept from the skies by the Luftwaffe. Because France this year will begin the long, steep climb back to the status of a world air power after a decade of war, defeat, and postwar confusion.

The map for the first leg of this climb will be the French Air Ministry's five-year plan for the reorganization and integration of all branches of French aviation (AVIATION WEEK, Dec. 26). This is slated to be approved by the National Assembly within the near future.

▶ **Defense**—First objective of the plan is to give France minimum air defense within the framework of the Atlantic Pact. Long range objective is to create a sound kernel around which French military and commercial air power, and the aircraft industry can grow rationally and steadily. Behind this long range target is the French dream of once again making an important contribution to the progress of world aviation. Air power symbolizes national self respect, independence, and vigor to the French. France won't completely regain its pre war self confidence until it possesses a modern air force and a sound aircraft industry.

But that doesn't mean French airmen have any illusions about their country again becoming a first class air power. Five years of reckless experimentation have taught them the bitter lesson that France no longer has the economic potential to back a balanced air force.

The French hope that by concentrating their resources and specializing their industry and air force they will be able to play an important role once again in the saga of world aviation.

The five year plan reflects these modest, realistic objectives. And it promises French pilots that they will be flying French airframes again soon.

▶ **Pact**—The Atlantic Pact has made the reorganization program possible by defining and limiting the role of French air power in the defense of Western Europe, and by supplementing French investments. France, under the Pact, will have the triple job of defending its own skies, providing tactical support for its ground forces, and policing and tying together the sprawling French Union. Thus the Pact frees the French from the obligation of building and

supporting a strategic air force.

But it's still not certain that the economy minded French National Assembly will vote the funds necessary to attain even these limited goals. So the five-year investment plan will be presented for approval in two slices.

▶**Absolute Minimum**—The first is the absolute minimum investment required to give the country the nucleus of a modern air force and aircraft industry. This wouldn't be big enough to fulfill French air obligations in the Atlantic defense system.

The second investment slice, which includes and supplements the first, would bring the French air force up to the minimum strength called for by the Atlantic strategists.

The use to which foreign military aid funds are put will vary depending on whether the National Assembly adopts the full investment program or merely the first minimum slice. In the latter case an important part of foreign aid will be spent on renovating France's tired P-47s. If the whole program is approved this money would be spent on equipping new French jets or buying foreign jets.

▶**How It Works**—The following table shows the total Government credits for the Air Force, Naval Air Force, and aircraft industry which will be asked for during the five years of the plan:

	Minimum Investment (billions of francs)		Optimum Investment	
Year	Total	For Airplane Construction	Total	For Airplane Construction
First	90	30	90	40
Second	120	30	180	75
Third	140	30	200	75
Fourth	160	30	215	75
Fifth	155	30	220	75
Sixth	115	30	200	75

Investment levels for the sixth year above are given to show approximately the normal volume of credits French air forces and aircraft industry would need in the years following termination of the program. Actually French airmen expect sixth year figures to be slightly higher under the minimum investment schedule, owing to the fact that a subsequent program of prototype development probably will be initiated about half way through the five year plan and will be reaching topspeed by the end of the plan.

It still is too early to predict what additional credits will be needed to develop and put into production new prototypes. But according to unofficial estimates the total credits which would be needed under the minimum investment schedule in the sixth year would be about 140 billion francs. If the optimum investment program is adopted no supplementary credits would be needed.

As the table indicates, adoption of

the optimum program would permit two and a half times the investment in new aircraft provided for in the minimum program. This would nearly double France's combat force. The explanation of this disproportionate return is that there is an irreducible minimum which must be spent each year for airfields, air force personnel, and so forth.

▶ **Air Power**—The comparison between the minimum and optimum investments in terms of air power proper is as follows:

The minimum program would give France at the end of five years the basic framework indispensable to a modern air force—air fields, radar installations, laboratories, and training schools. It also would pay for a tactical air force of 1100 first line combat planes, 850 of which would be jets, plus 1200 training, transport, and liason planes. That adds up to a total of 2300 planes. The program also calls for increasing the strength of the present air force from 75,000 to 110,000 over the five year period now planned.

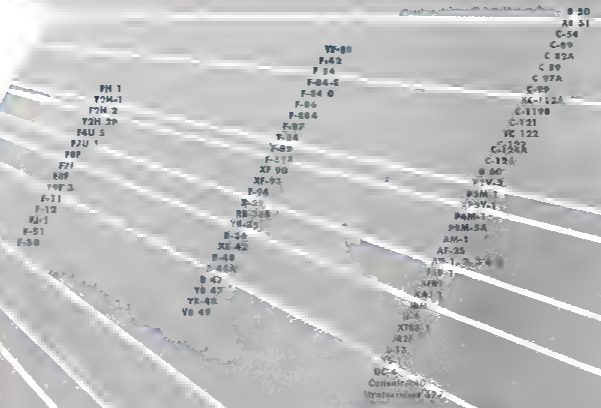
The optimum program would buy 2150 first line combat craft, of which 1800 would be jets and 1500 training, transport, and liason planes. The more ambitious program also would give France a more varied and flexible air force as well as a bigger one. For example, it would make it possible to build some night fighter and low level attack squadrons which aren't provided for in the minimum investment plan. It would provide for carrier based fighters and torpedo bombers for the Navy, whereas under the smaller program the Navy will have to do its best with the same land based fighters used by the Air Force. Finally, metropolitan radar installations would be perfected and overseas airfields and installations would be thoroughly modernized. The optimum plan calls for an increase of Air Force personnel to 150,000 from 75,000.

▶ **Plan Functions**—But no matter which investment level is approved by the National Assembly the basic functions of the five year plan will be unchanged. These are to provide continuity for the air force and the aircraft industry, and above all to concentrate the industry's resources.

Thus, the number of French nationalized aircraft companies already has been reduced from four to three. Eight airframe factories have been shut down and at least one more is slated to be closed. The total number of workers employed by the industry has been slashed to 20,000 from a postwar peak of over 100,000. But this labor force can be quickly expanded to 34,000 increasing production capacity 30 per

(Continued on page 138)

LEAR aircraft equipment



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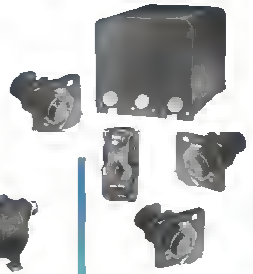

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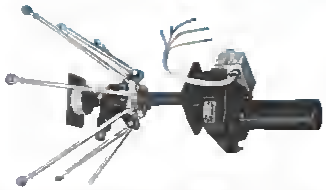
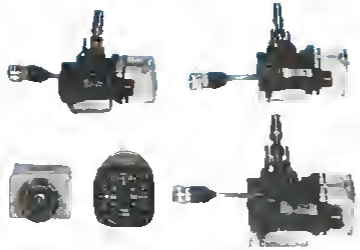


Jet Engine INLET AIR SHUTOFF AND ICING SCREEN ACTUATING SYSTEMS. 400 ~ motor operated. Max. operating load up to 2500 lbs

AIR SCOOP LINEAR ACTUATOR CONTROL. Noise filtered DC Motor, limit switch controlled. Max. operating load up to 450 lbs.

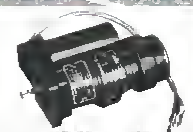


Synchronized TWIN RUDDER AND AILERON TRIM TAB control system with cockpit control and indicator

AILERON TRIM TAB CONTROL SYSTEM — DC motor operated Rotary Actuator, Flexible Shafting, Screw Jack. Max. operating loads up to 500 lbs.

Synchronized LINEAR ACTUATOR WING FLAP system — Max. operating loads up to 2500 lbs per system

ELEVATOR TRIM TAB CONTROL SYSTEM. DC Motor operated Rotary Actuator, Flexible Shafting "Y" drive and Screw Jacks. Max. operating loads up to 1000 lbs



Heating, Ventilating or Anti-icing valve ROTARY ACTUATOR — Noise filtered DC Motor, limit switch controlled

DC Motor Driven WATER-ALCOHOL INJECTION PUMP (Fully submerged) 250 gph, 58 psi, 2800 rpm

Jet Engine NOZZLE POSITIONER SYSTEM. Electronic Controlled Linear Actuator with cockpit position control transmitter. Max. operating loads up to 1000 lbs

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SNCASO 95

Breguet 761

SE 2010

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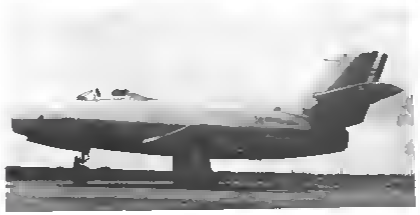


Dassault MD 450

cent without adding additional plant capacity.

Scheduled concentration of the number of planes to be manufactured is even more drastic. A year and a half ago the French aircraft industry was working on 65 prototypes. A maximum of 15 will be retained under the five year plan. The Air Force will be made up of 12 basic types (AVIATION WEEK, Dec. 26). Where possible these will be made to do double duty in the commercial air fleet as in the case of the medium transport Nord 2500 for example.

▶**Plane Orders**—Some modifications have been made in the provisional list of airplanes to be ordered for the Air Force within the framework of the 12 basic types.

- **The SO 6020** will be discontinued. It will be replaced as all weather fighter by a new "mystery" plane being built by Dassault. Details of this plane still are top secret. But it will be a larger version of the MD 450 "Ouragan" with sharply swept back very thin wings. It will carry a crew of two instead of one, have supplementary fuel tanks, complete radar equipment.
- **The SO 95 "Corse"** will be bought in small quantities only for the Navy.
- **The Nord 1221** will be replaced by the Morane Saulnier MS 732 as trainer and liason plane. Finally, the Snd Est SE 4000 will get the job of light amphibian in place of the SCAN 30.

Work also will be continued with Air Force funds on a number of experimental prototypes in addition to the basic military list. About 12 billion francs are to be spent for this purpose this year. The Leduc 010 ramjet, which many French airmen think may be the Air Force's fighter of the future, leads the experimental list. Breguet's twin deck economical cargo plane the 761 also will be pushed.

▶**Tropicalized Craft**—A project for a tropicalized single engine monoplane to do feeder line work in the French Overseas Territories also is under consideration. The proposed prototype now being studied by the Air Force is called the J.D.M.-14 and would have the following characteristics: Span 47.8 ft.; length 34.4 ft.; total surface 334 sq. ft.; power at takeoff 570 hp.; weight empty 3185 lb., payload 3185 lb., total weight 7026 lb.; minimum flying speed 62 mph.; landing speed 55 mph.; cruising speed 210 mph.; takeoff run 1150 ft.; landing run 650 ft.; radius of action 650 miles; fuel consumption 20 gal./hr.; powered by single Pratt or Alvis.

Work also will be continued on the giant transport SE 2010 "Armagnac". Fifteen of these ships are under construction; probably will be bought by Air France for the North Atlantic run.

The five year plan also provides for the construction of a four-jet transport. The sum of 600 million francs tentatively has been set aside for this project this year. But sharp conflicts have arisen between the Air Force and the civil air authorities and even within the Air Force itself as to what plane to concentrate on.

▶**Sud Ouest Favored**—Civil air authorities by and large favor the Sud Ouest prototype project SO 5100 to be named the "Champagne." On the drawing board this plane resembles the Comet very closely. It would be powered with four Nenes fitted with post-combustion devices and would cost four to five billion francs to develop, spread over three or four years. The company wants to build two prototypes; estimates that the ship could be in commercial operation by 1955.

Dassault also has a secret four jet transport project on his drawing boards, which civil air authorities are studying with interest.

Most key military officials, however, are opposed to these projects particularly to the "Champagne." They argue that the plane would merely imitate the Comet and that the Comet is only a stepping stone to a definite jet transport because it isn't a true trans-Atlantic plane. They would like to see France make a few Comets under license to gain experience while concentrating the main effort on developing a "Super-Comet"—in other words a practical inter-continental jet passenger transport.

Alternatively, they suggest equipping suitable existing commercial airframes with turboprops as a middle of the way stop gap measure while waiting for the development of a practical jet plane.

▶**Air Force Ace**—This issue still is wide open and won't be settled over night. But the Air Force holds a strong card in the debate. It finances 90 percent of all aircraft construction which is undertaken in France.

The five-year plan also provides for economical use of Air Force manpower through the formation and intensive training of a large reserve corps, and through turning much Air Force repair work over to the nationalized aircraft factories. In line with this latter step, the Air Force eventually would like to be able to contract for so many flying hours in a given plane instead of just a plane.

That's the blueprint of the first phase of French aviation's planned comeback. French airmen admit that it's just a start, that France still won't have an air force capable of defending its skies for more than a few weeks by 1955. But it is a start in the direction of air sovereignty. French aviation definitely has turned its back on the most tragic decade in its history.

Canada

Moves toward closer air power integration with U.S. and U.K.

Canadian military and civil aviation is tending more and more to become standardized with that of the United States. Practically all transports flown on military and civil routes now are of American design, and some military aircraft are now also being built in Canada on agreement with United States manufacturers.

In addition there has been some interchange with Great Britain, where Canadian designed de Havilland Chipmunk trainers are now being produced for the British air services, while British built jet transports have been ordered for Canadian civil aviation routes.

▶**F-86A Tooling**—Canada has started tooling up at the Canadair Ltd. plant at Montreal for production of the F-86A jet fighter, 100 of which are to be built for the Royal Canadian Air Force at cost of $30 million. The company, owned by Electric Boat Co. of New York, has completed orders for the Canadian version of the DC-4 for British Overseas Airways Corp. and for Canadian Pacific Airlines. It has sales men out trying to obtain F-86A orders from other countries.

Also at Montreal, Canadian Car & Foundry Co. Ltd., a subsidiary of American Car & Foundry, is understood to be negotiating to build the Super DC-3 in Canada. Company is also working on a 30 ton payload Burnelli flying wing type aircraft for possible use by the USAF.

U.S. military and commercial airline operators have been in Canada testing the Burnelli Loadmaster, prototype of the flying wing type built by Canadian Car & Foundry some years ago. The aircraft has also been tested by Canadian military services. Canadian Car is servicing Fairey Firefly aircraft used by the Royal Canadian Navy.

▶**Avro Canada Jets**—At Toronto two Canadian jet aircraft have now been test flown. A. V. Roe Canada Ltd., has started on tests of its CF-100, twin engine jet all-weather long-range fighter built at cost of $7 million for the RCAF. Ten of these fighters have been ordered. A jet transport is nearing completion of its airworthiness tests and while no orders have been announced yet, it has been watched by American airline and military experts.

The Avro Jetliner, of which a second one is now nearing completion, was also built for the RCAF as a transcontinental transport, with commercial model to seat 50 passengers. Avro Canada received $5 million in subsidies from Canadian government on this job.

▶**De Havilland Plans**—De Havilland Aircraft of Canada Ltd., is continuing production at Toronto of its postwar Canadian-designed Beaver single-engine freighter for Canadian and Latin American companies and government. It is negotiating to build its postwar Chipmunk tandem trainer for the government sponsored flying clubs, and is completing a number of orders for these trainers for the Egyptian and Siamese governments. It has set up first jet-engine overhaul plant in Canada recently, to look after engines in RCAF British Vampire fighters.

These are the main manufacturing plants in Canada, but some small plants and engine overhaul operations are busy throughout Canada.

▶**Defense Picture**—Canada is spending $383 million on defense in the current fiscal year, ending March 31, 1950, with 42.6 percent being spent on the RCAF. Defense Minister Brooke Claxton a few weeks ago stated at Calgary that Canada is spending $50 million on contracts for aircraft, $40 million of that is going into jet planes. "This is a higher percentage than any country we know of," Claxton stated. The aircraft expenditures make Canada rank fourth or fifth highest among the nations of the world in aircraft expenditures he said.

"Assertions as to adequacy of our defense must be considered as to likelihood and scale of attack," Claxton told a press conference. "No defense is ever adequate in the minds of those who are in charge of it. A population of 13 million (Canada's) is not big enough even if all the money was spent on defense, to defend alone against greater powers."

▶**Jet Spending**—Among defense expenditures is $21 million on defense research. Bulk of this is being spent on jet aircraft and jet engines as well as new supersonic wind tunnel at Ottawa. Jet engines are being built for the first time at Toronto by A. V. Roe Canada Ltd., which has completed tests on its Orenda engine to be used on the CF-100 fighter.

▶**RCAF Recruiting**—Canada is nearing its quota on recruiting for the RCAF.

A radar warning service in the far north is understood to be under construction jointly with the United States.

▶**Civil Picture**—From a civilian aviation standpoint, Canadian aviation is also going ahead. The past year has seen the inauguration of new international routes by the government's Trans-Canada Airlines to South America and the expansion of domestic transcontinental service, all with Canadian-built DC-4 aircraft. Canadian Pacific Air-

lines has started its services in recent months to Australia and Hong Kong, using DC-4 aircraft built at Montreal It has ordered two British de Havilland Comet jet aircraft for its trans Pacific routes, and has option on two more aircraft

Canadian air transport companies during the first seven months of 1949 flew 213,200,000 passenger revenue miles, and 2,669,000 revenue ton miles, considerably more than for the same period the year before These are latest figures of the Dominion Bureau of Statistics, Ottawa

Reports from individual airlines are not yet all available, but that of TCA for 1949 shows the airline carried 690,000 passengers in 1949, an increase of 23 percent over 1948 It operates with 20 DC-4 North Star aircraft and 27 DC-3s converted from war surplus aircraft Smaller Lockheed aircraft have all been sold

KLM began operations from Holland to Canada in 1949, but no Canadian service goes direct to Holland as yet Canada is awaiting inauguration of new service which is pending, awaiting the settlement of air agreement made last June

The Canadian government is currently spending $10 million on improvements to major Canadian airports used for scheduled domestic and international air transport

Aussie Production

Regulations issued under a 1939 defense act and its 1948 amendment confer sweeping powers on the Australian Government to "compulsory acquire property, machinery, equipment, plant or anything else necessary for the production of war material."

The regulations empower the Minister for Supply and Development to make contracts, grant financial assistance to individuals and authorize purchase, requisition or compulsory acquisition of any goods and to arrange compensation for persons affected by the exercise of these powers and of other powers

The government has authority to decide in peacetime which industries and individuals are required to advance defense research and make supplies of war materials

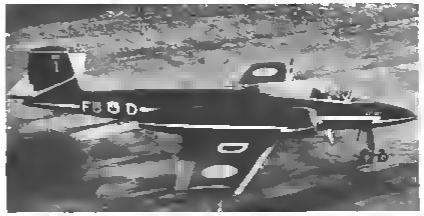
New organizations to be set up under the regulations are a Contract Board a Munitions Board, an Aircraft Board and a Research and Development Board

Canadian, British and French Jet Engines

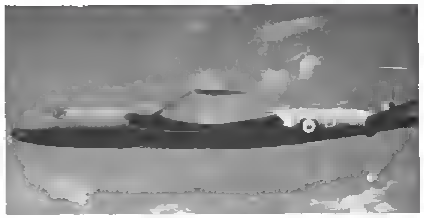
Manufacturer	Model	Type	Compressor stages	Turbine stages	Compression ratio	Static thrust (lb.)	At rpm.	Rated thrust (lb.)	At rpm.	At altitude (ft.)	Maximum overspeed (rpm)	Shaft hp	At rpm (S. L.)	Specific fuel cons. (lb./lb. thrust/hr.)	Turbine inlet (F deg.)	Tailpipe (F deg.)	Length (in.)	Diameter (in.)	Weight, dry (lb.)
CANADA																			
A. V. Roe Canada, Ltd.	Orenda	TJ	11AF[1]			7000*[1]											135[1]	42[1]	
	Chinook	TJ	9AF	1	4.5:1	2600	10,100							1.04	1112	1202	125	32	1250
ENGLAND																			
Bristol Aeroplane Co., Ltd.	Proteus	TP	13AF	3		800	10,000					3200	10,000	.63[2]			113.3	38.5	3050
	Coupled Proteus	TP	13AF	3		1600	10,000					6400	10,000	.63[2]			167.3	80.4	7180
	Theseus 502	TP	9AF	3	4.25:1	825	8200	145	7800	20,000		2220	8200	.773[2]	1470	1020	82.6	54	2205
de Havilland Engine Co., Ltd.	Goblin 35	TP	1CF	1		3500	10,750	2950[3]	10,250	S. L.	11,075			1.13[3]		1274	108.5	50	1619
	Ghost	TJ	1CF	1		5000	10,250	4300[3]	9750	S. L.	10,550			1.04[3]		1292	121	53	2174
Rolls-Royce, Ltd.	Avon R. A. 2	TJ	AF			6000								1.00			125	41.5	2450*
	Tay	TJ	1CF	1		6250											103.2[4]	50	2000*
	Nene	TJ	1CF	1	4:1	5000[5]	12,300							1.00	1526	1166	96.8	49.5	1550[6]
	Derwent 5	TJ	1CF	1	4:1	3500[5]	14,700							1.00	1526	1166	83.1	43	1250[6]
	Dart	TP	2CF	2	5.5:1							1400	14,500	.83	1526	1004	95.18	38.5	929
FRANCE																			
Hispano-Suiza	Nene 102	TJ	1CF	1	4:1	5000	12,300	4600	12,000	S. L.				1.065	1607	1292	96.8	49.5	1550
Rateau	SRA 101	TJ	10AF	2	6.8:1	8800	9500							1.88	1742	1202	121[7]	43	2200

* — approximate
TJ — turbojet
TP — turboprop
AF — axial flow
CF — centrifugal flow
1 — Aviation Week estimate
2 — at lb./hr./ehp
3 — maximum continuous thrust
4 — without after burner
5 — type test rating
6 — includes accessories
7 — without tailpipe

Among British & Canadian Planes . . .



Avro Canada CF 100



English Electric Canberra B 1

Avro Canada Jetliner

Vickers Armstrongs Viscount

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Supermarine 510

de Havilland DH 106 Comet

Armstrong Whitworth AW. 55 Apollo

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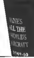

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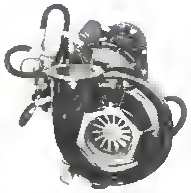

STRATOS S60-1
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